

GENERAL INFORMATION

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SECTION

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GENERAL INFORMATION 00-00

00-00 GENERAL INFORMATION

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HOW TO USE THIS MANUAL

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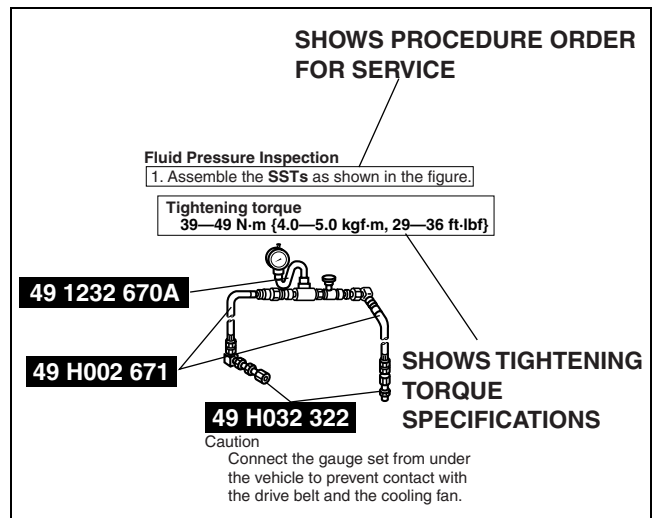
Range of Topics

- This manual contains procedures for performing all required service operations. The procedures are divided into the following five basic operations:
 - Removal/Installation
 - Disassembly/Assembly
 - Replacement
 - Inspection
 - Adjustment
- Simple operations which can be performed easily just by looking at the vehicle (i.e., removal/installation of parts, jacking, vehicle lifting, cleaning of parts, and visual inspection) have been omitted.

Service Procedure

Inspection, adjustment

- Inspection and adjustment procedures are divided into steps. Important points regarding the location and contents of the procedures are explained in detail and shown in the illustrations.



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Repair procedure

1. Most repair operations begin with an overview illustration. It identifies the components, shows how the parts fit together, and describes visual part inspection. However, only removal/installation procedures that need to be performed methodically have written instructions.
2. Expendable parts, tightening torques, and symbols for oil, grease, and sealant are shown in the overview illustration. In addition, symbols indicating parts requiring the use of special service tools or equivalent are also shown.

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3. Procedure steps are numbered and the part that is the main point of that procedure is shown in the illustration with the corresponding number. Occasionally, there are important points or additional information concerning a procedure. Refer to this information when servicing the related part.

Procedure

↓

①

"Removal/Installation" Portion

②

"Inspection After Installation" Portion

INSTALL THE PARTS BY PERFORMING STEPS 1—3 IN REVERSE ORDER

SHOWS SERVICE ITEM (S)

INDICATES ANY RELEVANT REFERENCES WHICH NEED TO BE FOLLOWED DURING INSTALLATION

SHOWS SPECIAL SERVICE TOOL (SST) FOR SERVICE OPERATION

SHOWS APPLICATION POINTS OF GREASE, ETC.

SHOWS TIGHTENING TORQUE SPECIFICATIONS

SHOWS NON-REUSEABLE PARTS

SHOWS DETAILS

SHOWS TIGHTENING TORQUE UNITS

SHOWS THERE ARE REFERRAL NOTES FOR SERVICE

LOWER TRAILING LINK, UPPER TRAILING LINK REMOVAL/INSTALLATION

1. Jack up the rear of the vehicle and support it with safety stands.
2. Remove the undercover. (See 01-10-4 Undercover Removal)
3. Remove in the order indicated in the table.
4. Install in the reverse order of removal.
5. Inspect the rear wheel alignment and adjust it if necessary.

1	Split pin
2	Nut
3	Lower trailing link ball joint (See 02-14-5 Lower Trailing Link Ball Joint Removal Note)
4	Bolt
5	Lower trailing link
6	Dust boot (lower trailing link)

7	Split pin
8	Nut
9	Upper trailing link ball joint (See 02-14-5 Upper Trailing Link Ball Joint Removal Note)
10	Nut
11	Upper trailing link
12	Dust boot (upper trailing link)

Lower Trailing Link Ball Joint, Upper Trailing Link Ball Joint Removal Note

- Remove the ball joint using the SSTs.

SHOWS SPECIAL SERVICE TOOL (SST) NO.

49 T028 304 UPPER TRAILING LINK
49 T028 305 LOWER TRAILING LINK


KNUCKLE

49 T028 303

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Symbols

- There are eight symbols indicating oil, grease, fluids, sealant, and the use of SST or equivalent. These symbols show application points or use of these materials during service.

Symbol	Meaning	Kind
	Apply oil	New appropriate engine oil or gear oil

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Symbol	Meaning	Kind
	Apply brake fluid	New appropriate brake fluid
	Apply automatic transaxle/ transmission fluid	New appropriate automatic transaxle/ transmission fluid
	Apply grease	Appropriate grease
	Apply sealant	Appropriate sealant
	Apply petroleum jelly	Appropriate petroleum jelly
	Replace part	O-ring, gasket, etc.
	Use SST or equivalent	Appropriate tools

Advisory Messages

- You will find several **Warnings**, **Cautions**, **Notes**, **Specifications** and **Upper and Lower Limits** in this manual.

Warning

- A Warning indicates a situation in which serious injury or death could result if the warning is ignored.

Caution

- A Caution indicates a situation in which damage to the vehicle or parts could result if the caution is ignored.

Note

- A Note provides added information that will help you to complete a particular procedure.

Specification

- The values indicate the allowable range when performing inspections or adjustments.

Upper and lower limits

- The values indicate the upper and lower limits that must not be exceeded when performing inspections or adjustments.

UNITS

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Electric current	A (ampere)
Electric power	W (watt)
Electric resistance	ohm
Electric voltage	V (volt)
Length	mm (millimeter)
	in (inch)
Negative pressure	kPa (kilo pascal)
	mmHg (millimeters of mercury)
	inHg (inches of mercury)

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Positive pressure	kPa (kilo pascal)
	kgf/cm ² (kilogram force per square centimeter)
	psi (pounds per square inch)
Number of revolutions	rpm (revolutions per minute)
Torque	N·m (Newton meter)
	kgf·m (kilogram force meter)
	kgf·cm (kilogram force centimeter)
	ft·lbf (foot pound force)
	in·lbf (inch pound force)
Volume	L (liter)
	US qt (U.S. quart)
	Imp qt (Imperial quart)
	ml (milliliter)
	cc (cubic centimeter)
	cu in (cubic inch)
	fl oz (fluid ounce)
Weight	g (gram)
	oz (ounce)

Conversion to SI Units (Système International d'Unités)

- All numerical values in this manual are based on SI units. Numbers shown in conventional units are converted from these values.

Rounding Off

- Converted values are rounded off to the same number of places as the SI unit value. For example, if the SI unit value is 17.2 and the value after conversion is 37.84, the converted value will be rounded off to 37.8.

Upper and Lower Limits

- When the data indicates upper and lower limits, the converted values are rounded down if the SI unit value is an upper limit and rounded up if the SI unit value is a lower limit. Therefore, converted values for the same SI unit value may differ after conversion. For example, consider 2.7 kgf/cm² in the following specifications:

210—260 kPa {2.1—2.7 kgf/cm², 30—38 psi}

270—310 kPa {2.7—3.2 kgf/cm², 39—45 psi}

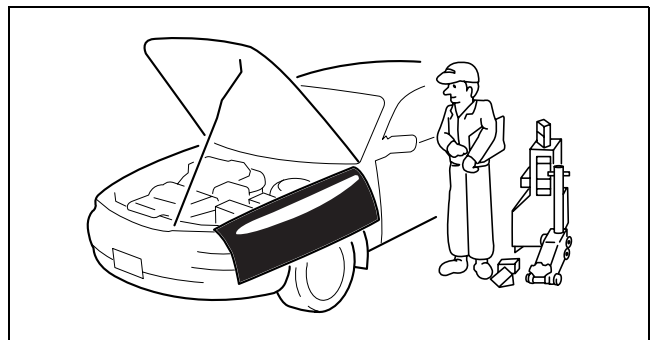
- The actual converted values for 2.7 kgf/cm² are 264 kPa and 38.4 psi. In the first specification, 2.7 is used as an upper limit, so the converted values are rounded down to 260 and 38. In the second specification, 2.7 is used as a lower limit, so the converted values are rounded up to 270 and 39.

FUNDAMENTAL PROCEDURES

Preparation of Tools and Measuring Equipment

- Be sure that all necessary tools and measuring equipment are available before starting any work.

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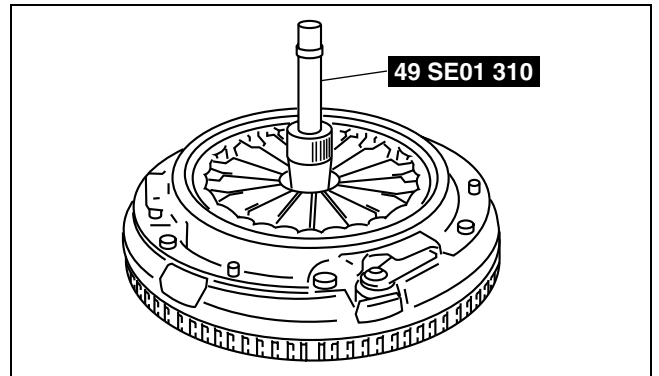


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Special Service Tools

- Use special service tools or equivalent when they are required.

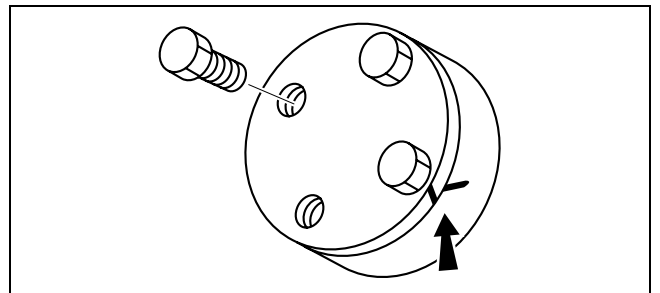


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Disassembly

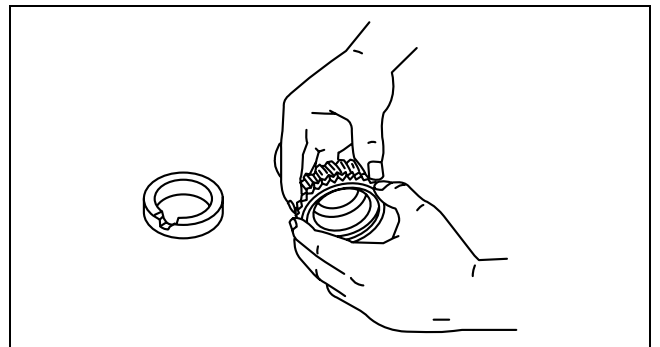
- If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be marked in a place that will not affect their performance or external appearance and identified so that reassembly can be performed easily and efficiently.



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Inspection During Removal, Disassembly

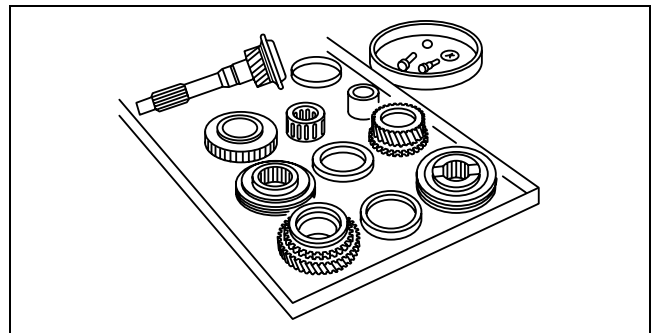
- When removed, each part should be carefully inspected for malfunction, deformation, damage and other problems.



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Arrangement of Parts

- All disassembled parts should be carefully arranged for reassembly.
- Be sure to separate or otherwise identify the parts to be replaced from those that will be reused.



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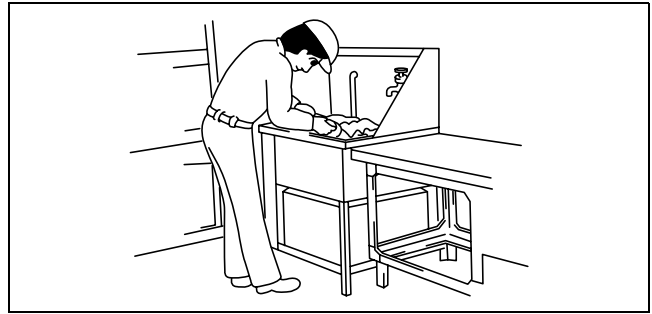
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Cleaning of Parts

- All parts to be reused should be carefully and thoroughly cleaned in the appropriate method.

Warning

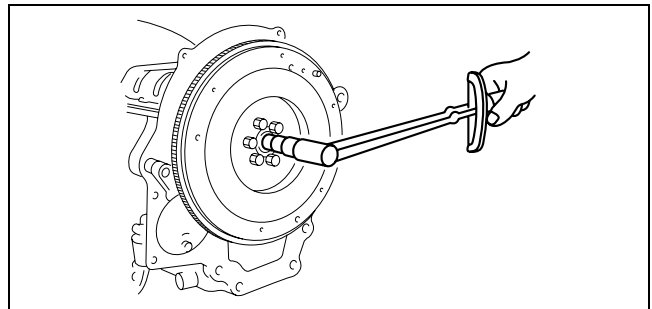
- **Using compressed air can cause dirt and other particles to fly out causing injury to the eyes. Wear protective eye wear whenever using compressed air.**



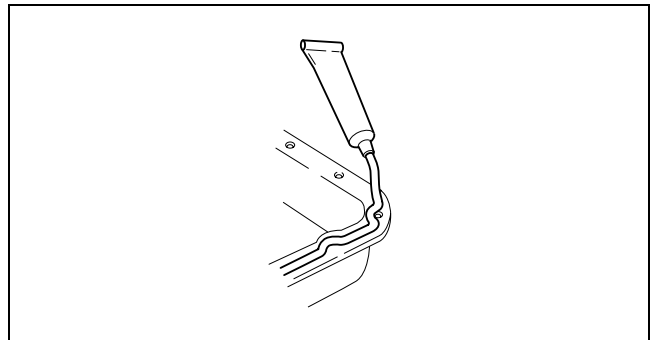
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Reassembly

- Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.
- If removed, the following parts should be replaced with new ones:
 - Oil seals
 - Gaskets
 - O-rings
 - Lockwashers
 - Cotter pins
 - Nylon nuts
- Depending on location:
 - Sealant and gaskets, or both, should be applied to specified locations. When sealant is applied, parts should be installed before sealant hardens to prevent leakage.
 - Oil should be applied to the moving components of parts.
 - Specified oil or grease should be applied at the prescribed locations (such as oil seals) before reassembly.



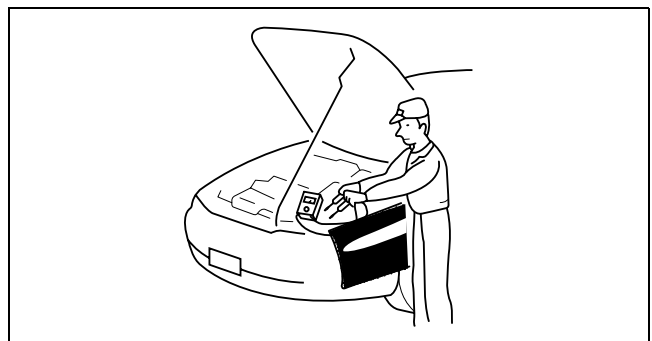
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Adjustment

- Use suitable gauges and testers when making adjustments.

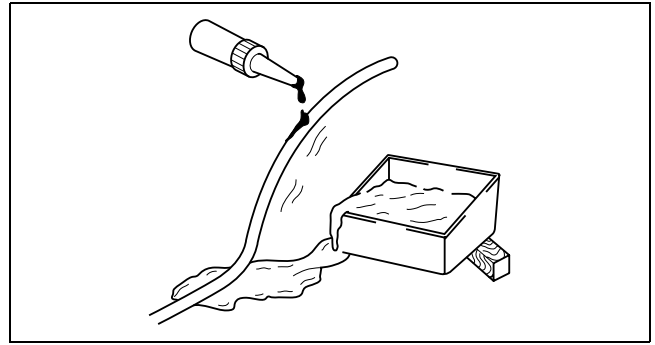


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Rubber Parts and Tubing

- Prevent gasoline or oil from getting on rubber parts or tubing.

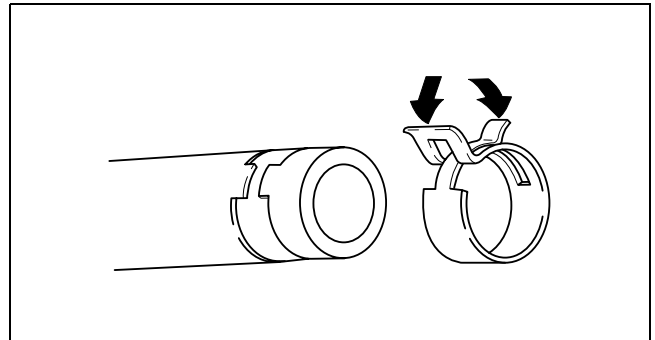


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Hose Clamps

- When reinstalling, position the hose clamp in the original location on the hose and squeeze the clamp lightly with large pliers to ensure a good fit.

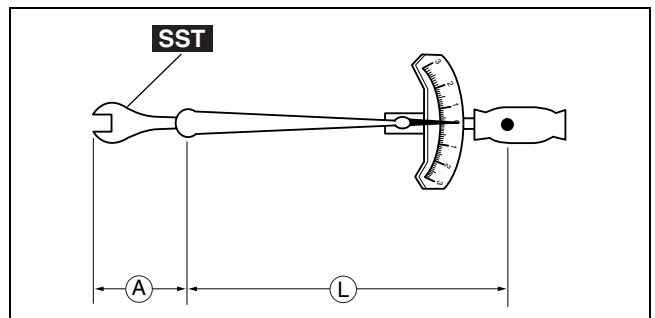


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Torque Formulas

- When using a torque wrench-SST or equivalent combination, the written torque must be recalculated due to the extra length that the SST or equivalent adds to the torque wrench. Recalculate the torque by using the following formulas. Choose the formula that applies to you.

Torque Unit	Formula
N·m	$N \cdot m \times [L / (L + A)]$
kgf·m	$kgf \cdot m \times [L / (L + A)]$
kgf·cm	$kgf \cdot cm \times [L / (L + A)]$
ft·lbf	$ft \cdot lbf \times [L / (L + A)]$
in·lbf	$in \cdot lbf \times [L / (L + A)]$

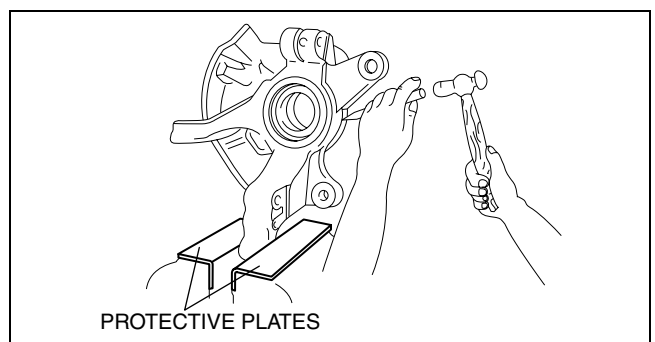


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- A : The length of the SST past the torque wrench drive.
 L : The length of the torque wrench.

Vise

- When using a vise, put protective plates in the jaws of the vise to prevent damage to parts.



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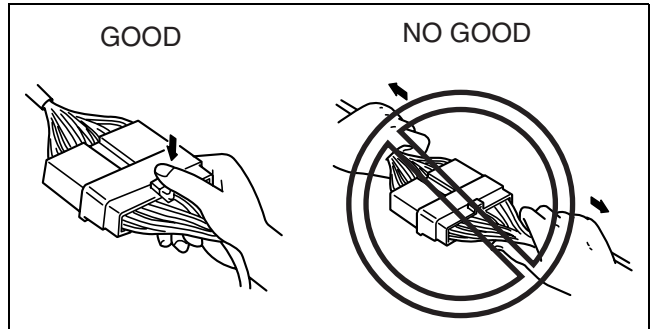
ELECTRICAL SYSTEM

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Connectors

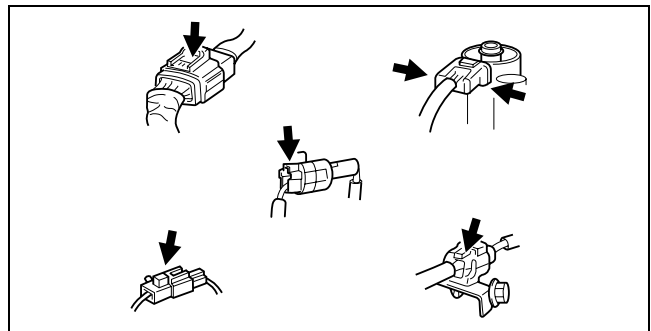
Disconnecting connectors

- When disconnecting connector, grasp the connectors, not the wires.



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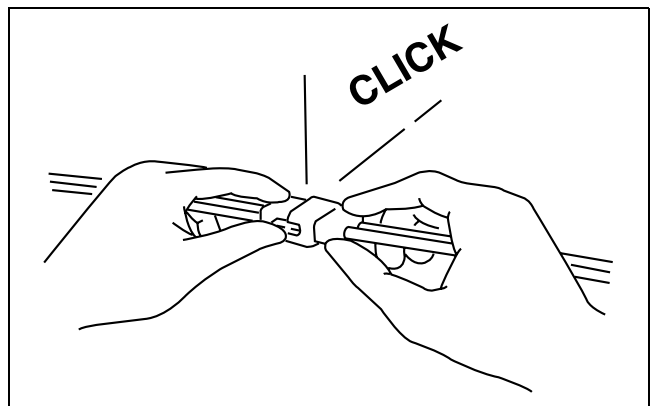
- Connectors can be disconnected by pressing or pulling the lock lever as shown.



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Locking connector

- When locking connectors, listen for a click indicating they are securely locked.



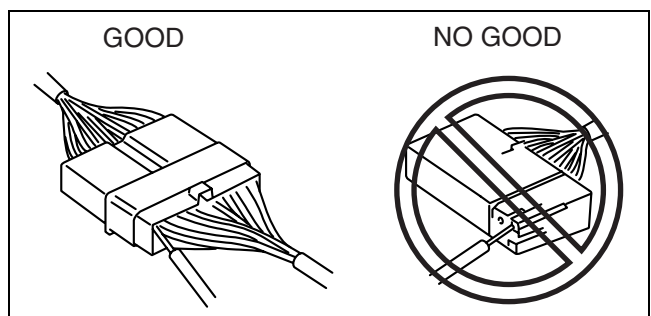
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Inspection

- When a tester is used to inspect for continuity or measuring voltage, insert the tester probe from the wiring harness side.
- Inspect the terminals of waterproof connectors from the connector side since they cannot be accessed from the wiring harness side.

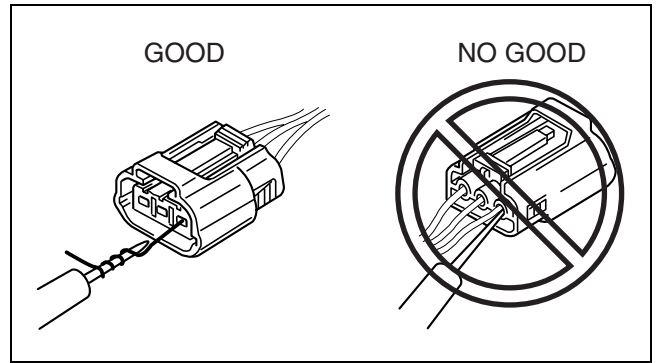
Caution

- To prevent damage to the terminal, wrap a thin wire around the tester probe before inserting into terminal.



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NEW STANDARDS

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- Following is a comparison of the previous standard and the new standard.

New Standard		Previous Standard		Remark
Abbreviation	Name	Abbreviation	Name	
AP	Accelerator Pedal	—	Accelerator Pedal	
ACL	Air Cleaner	—	Air Cleaner	
A/C	Air Conditioning	—	Air Conditioning	
BARO	Barometric Pressure	—	Atmospheric Pressure	
B+	Battery Positive Voltage	Vb	Battery Voltage	
—	Brake Switch	—	Stoplight Switch	
—	Calibration Resistor	—	Corrected Resistance	#6
CMP sensor	Camshaft Position Sensor	—	Crank Angle Sensor	
CAC	Charge Air Cooler	—	Intercooler	
CLS	Closed Loop System	—	Feedback System	
CTP	Closed Throttle Position	—	Fully Closed	
CPP	Clutch Pedal Position	—	Idle Switch	
CIS	Continuous Fuel Injection System	—	Clutch Position	
CS sensor	Control Sleeve Sensor	CSP sensor	Control Sleeve Position Sensor	#6
CKP sensor	Crankshaft Position Sensor	—	Crank Angle Sensor 2	
DLC	Data Link Connector	—	Diagnosis Connector	
DTM	Diagnostic Test Mode	—	Test Mode	#1
DTC	Diagnostic Trouble Code(s)	—	Service Code(s)	
DI	Distributor Ignition	—	Spark Ignition	
DLI	Distributorless Ignition	—	Direct Ignition	
EI	Electronic Ignition	—	Electronic Spark Ignition	#2
ECT	Engine Coolant Temperature	—	Water Thermo	
EM	Engine Modification	—	Engine Modification	
—	Engine Speed Input Signal	—	Engine RPM Signal	
EVAP	Evaporative Emission	—	Evaporative Emission	
EGR	Exhaust Gas Recirculation	—	Exhaust Gas Recirculation	
FC	Fan Control	—	Fan Control	
FF	Flexible Fuel	—	Flexible Fuel	
4GR	Fourth Gear	—	Overdrive	
—	Fuel Pump Relay	—	Circuit Opening Relay	#3
FSO solenoid	Fuel Shut Off Solenoid	FCV	Fuel Cut Valve	#6
GEN	Generator	—	Alternator	
GND	Ground	—	Ground/Earth	
HO2S	Heated Oxygen Sensor	—	Oxygen Sensor	With heater
IAC	Idle Air control	—	Idle Speed Control	
—	IDM Relay	—	Spill Valve Relay	#6
—	Incorrect Gear Ratio	—	—	
—	Injection Pump	FIP	Fuel Injection Pump	#6

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New Standard		Previous Standard		Remark
Abbreviation	Name	Abbreviation	Name	
—	Input/Turbine Speed Sensor	—	Pulse Generator	
IAT	Intake Air Temperature	—	Intake Air Thermo	
KS	Knock Sensor	—	Knock Sensor	
MIL	Malfunction Indicator Lamp	—	Malfunction Indicator Light	
MAP	Manifold Absolute Pressure	—	Intake Air Pressure	
MAF sensor	Mass Air Flow Sensor	—	Airflow Sensor	
MFL	Multiport Fuel Injection	—	Multiport Fuel Injection	
OBD	On-Board Diagnostic	—	Diagnosis/Self-Diagnosis	
OL	Open Loop	—	Open Loop	
—	Output Speed Sensor	—	Vehicle Speed Sensor 1	
OC	Oxidation Catalytic Converter	—	Catalytic Converter	
O2S	Oxygen Sensor	—	Oxygen Sensor	
PNP	Park/Neutral Position	—	Park/Neutral Range	
—	PCM Control Relay	—	Main Relay	#6
PSP	Power Steering Pressure	—	Power Steering Pressure	
PCM	Powertrain Control Module	ECU	Engine Control Unit	#4
—	Pressure Control Solenoid	—	Line Pressure Solenoid Valve	
PAIR	Pulsed Secondary Air Injection	—	Secondary Air Injection System	Pulsed injection
—	Pump Speed Sensor	—	NE Sensor	#6
AIR	Secondary Air Injection	—	Secondary Air Injection System	Injection with air pump
SAPV	Secondary Air Pulse Valve	—	Reed Valve	
SFI	Sequential Multipoint Fuel Injection	—	Sequential Fuel Injection	
—	Shift Solenoid A	—	12 Shift Solenoid Valve	
		—	Shift A Solenoid Valve	
—	Shift Solenoid B	—	23 Shift Solenoid Valve	
		—	Shift B Solenoid Valve	
—	Shift Solenoid C	—	34 Shift Solenoid Valve	
3GR	Third Gear	—	3rd Gear	
TWC	Three Way Catalytic Converter	—	Catalytic Converter	
TB	Throttle Body	—	Throttle Body	
TP sensor	Throttle Position Sensor	—	Throttle Sensor	
TCV	Timer Control Valve	TCV	Timing Control Valve	#6
TCC	Torque Converter Clutch	—	Lockup Position	
TCM	Transmission (Transaxle) Control Module	—	EC-AT Control Unit	
—	Transmission (Transaxle) Fluid Temperature Sensor	—	ATF Thermosensor	
TR	Transmission (Transaxle) Range	—	Inhibitor Position	
TC	Turbocharger	—	Turbocharger	
VSS	Vehicle Speed Sensor	—	Vehicle Speed Sensor	
VR	Voltage Regulator	—	IC Regulator	
VAF sensor	Volume Air Flow Sensor	—	Air flow Sensor	
WUTWC	Warm Up Three Way Catalytic Converter	—	Catalytic Converter	#5
WOT	Wide Open Throttle	—	Fully Open	

#1 : Diagnostic trouble codes depend on the diagnostic test mode

#2 : Controlled by the PCM

#3 : In some models, there is a fuel pump relay that controls pump speed. That relay is now called the fuel pump relay (speed).

#4 : Device that controls engine and powertrain

#5 : Directly connected to exhaust manifold

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#6 : Part name of diesel engine

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ABBREVIATIONS

B3E00000011201

ATDC	After Top Dead Center
ATX	Automatic Transaxle
EGR	Exhaust Gas Recirculation
EX	Exhaust
IN	Intake
MTX	Manual Transaxle
OCV	Oil Control Valve
TDC	Top Dead Center
SST	Special Service Tool

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 TECHNICAL DATA 01-50

SERVICE TOOLS 01-60

01-10 MECHANICAL

ENGINE OVERHAUL

SERVICE WARNING 01-10-1
 ENGINE MOUNTING/DISMOUNTING . . 01-10-1
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 CYLINDER HEAD (II) DISASSEMBLY . . 01-10-7
 CYLINDER BLOCK (I) DISASSEMBLY . 01-10-9
 CYLINDER BLOCK (II) DISASSEMBLY . 01-10-10
 CYLINDER HEAD INSPECTION 01-10-11
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 VALVE GUIDE REPLACEMENT 01-10-13
 VALVE SEAT INSPECTION/REPAIR . . . 01-10-14
 VALVE SPRING INSPECTION 01-10-15
 CAMSHAFT INSPECTION 01-10-15
 TAPPET INSPECTION 01-10-17
 CYLINDER BLOCK INSPECTION 01-10-17

OIL JET VALVE INSPECTION 01-10-18
 PISTON INSPECTION 01-10-18
 CRANKSHAFT INSPECTION 01-10-19
 CONNECTING ROD INSPECTION 01-10-21
 BOLT INSPECTION 01-10-21
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 VALVE CLEARANCE ADJUSTMENT . . 01-10-24
 CYLINDER BLOCK (I) ASSEMBLY . . . 01-10-27
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 CYLINDER HEAD (I) ASSEMBLY 01-10-36
 CYLINDER HEAD (II) ASSEMBLY 01-10-37
 TIMING CHAIN ASSEMBLY 01-10-40

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ENGINE OVERHAUL SERVICE WARNING

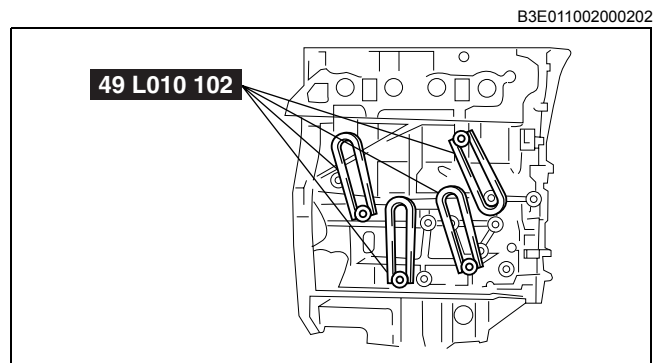
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Warning

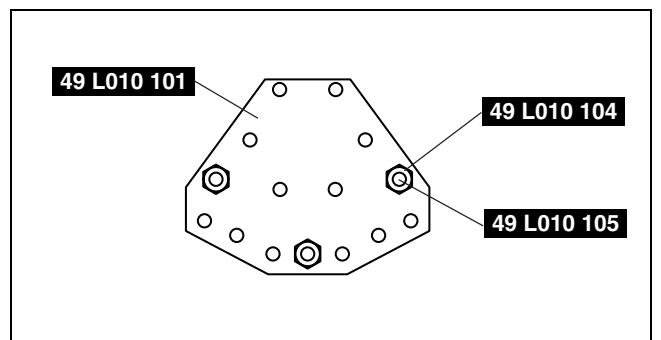
- Continuous exposure with USED engine oil has caused skin cancer in laboratory mice. Protect your skin by washing with soap and water immediately after this work.

ENGINE MOUNTING/DISMOUNTING

1. Install the **SSTs** (arms) to the cylinder block holes as shown, and hand-tighten the bolts (**part No.: 9YA20-1003**) or **M10 × 1.5T length 90 mm {3.55 in}**).



2. Assemble the **SSTs** (bolts, nuts and plate) to the specified positions.
3. Adjust the **SSTs** (bolts) so that less than **20 mm {0.79 in}** of thread is exposed.
4. Make the **SSTs** (arms and plate) parallel by adjusting the **SSTs** (bolts and nuts).

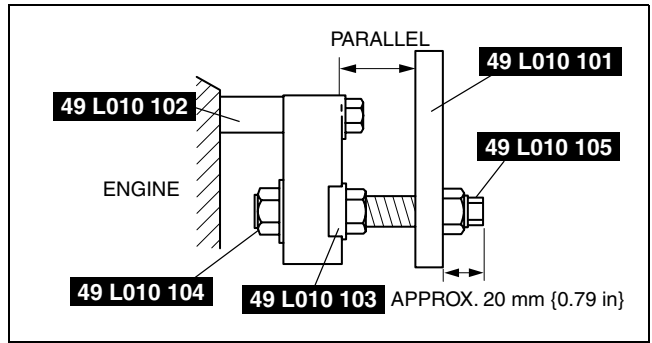


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5. Tighten the **SSTs** (bolts and nuts) to affix the **SSTs** firmly.

Warning

- Self-locking brake system of the engine stand may not be effective when the engine is held in an unbalanced position. This could lead to sudden, rapid movement of the engine and mounting stand handle and cause serious injury. Never keep the engine in an unbalanced position, and always hold the rotating handle firmly when turning the engine.



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6. Mount the engine on the **SST** (engine stand).
7. Drain the engine oil into a container.
8. Install the oil pan drain plug.
 - With washer
 1. Install the oil pan drain plug with a new washer.

Tightening torque

30—41 N·m {3.1—4.1 kgf·m, 23—30 ft·lbf}

- Without washer
 1. Inspect the seal rubber of the oil pan drain plug and make sure there are no cracks or damage.
 - If necessary, replace the oil pan drain plug.
 2. Clean the flange surface (seal rubber) on the oil pan drain plug, then install the oil pan drain plug.

Tightening torque

22—30 N·m {2.2—3.1 kgf·m, 16—22 ft·lbf}

DISMOUNTING

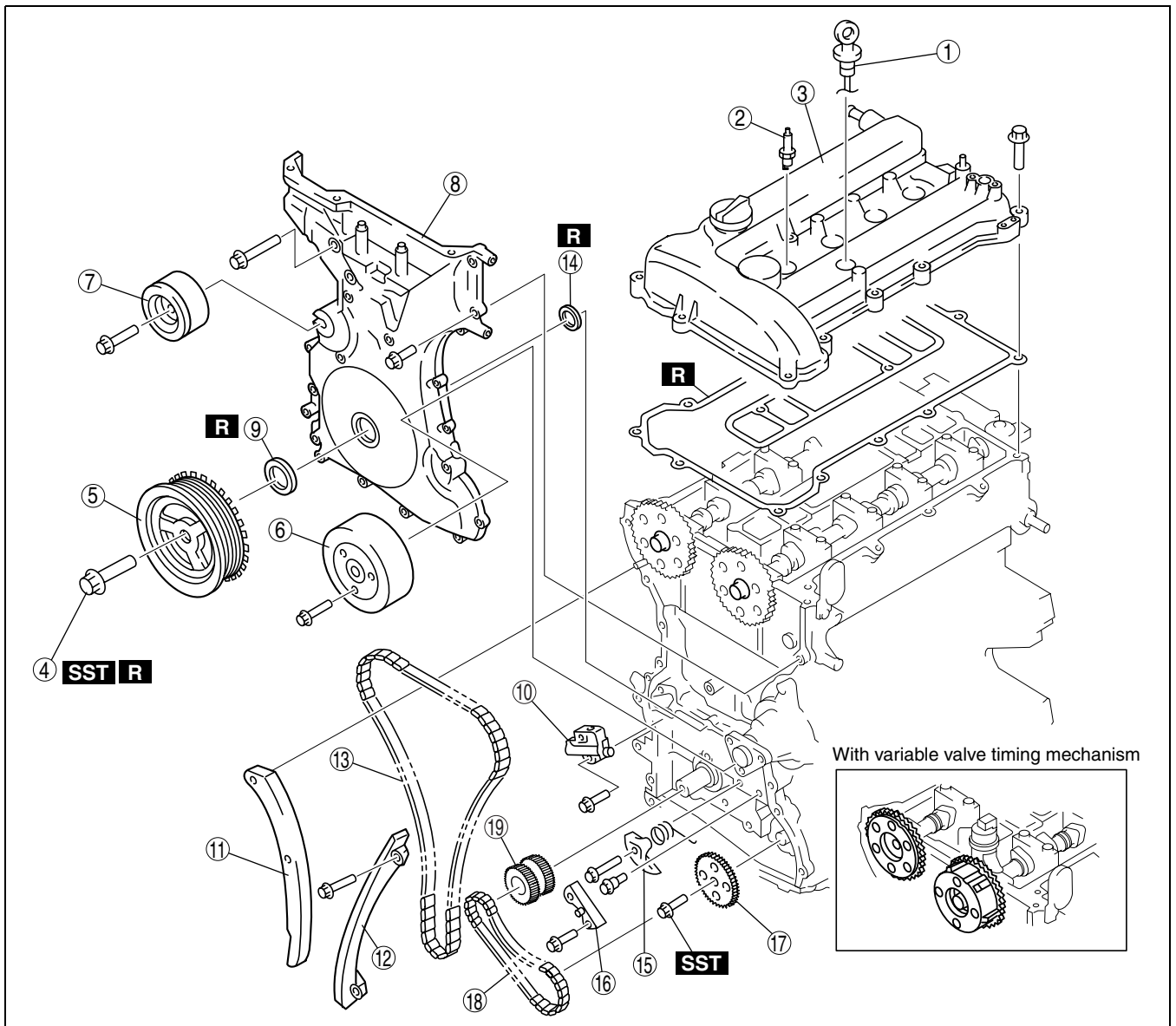
- Dismount in the reverse order of mounting.

MECHANICAL

TIMING CHAIN DISASSEMBLY

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1. Disassemble in the order indicated in the table.



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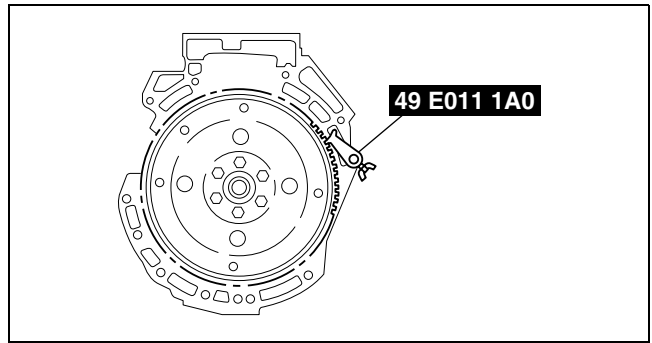
1	Oil level gauge (If equipped)
2	Spark plug
3	Cylinder head cover
4	Crankshaft pulley lock bolt (See 01-10-4 Crankshaft Pulley Lock Bolt Disassembly Note.)
5	Crankshaft pulley
6	Water pump pulley
7	Drive belt idler pulley (Without stretch-type A/C drive belt)
8	Engine front cover
9	Front oil seal (See 01-10-4 Front Oil Seal Disassembly Note.)

10	Chain tensioner (See 01-10-4 Chain Tensioner Disassembly Note.)
11	Tensioner arm
12	Chain guide
13	Timing chain
14	Seal (With variable valve timing mechanism)
15	Oil pump chain tensioner
16	Oil pump chain guide
17	Oil pump sprocket (See 01-10-4 Oil Pump Sprocket Disassembly Note.)
18	Oil pump chain
19	Crankshaft sprocket

MECHANICAL

Crankshaft Pulley Lock Bolt Disassembly Note

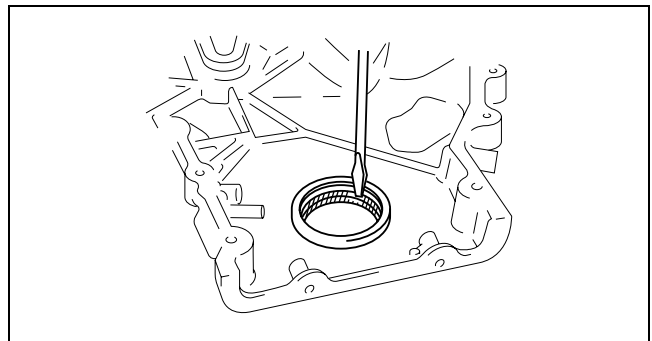
1. Install the **SST** to the ring gear to lock the crankshaft against rotation.



E6U110ZEB033

Front Oil Seal Disassembly Note

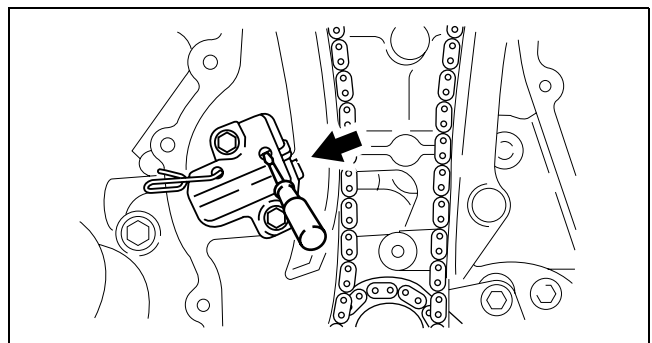
1. Remove the oil seal using a flat head screwdriver.



B3E0110E053

Chain Tensioner Disassembly Note

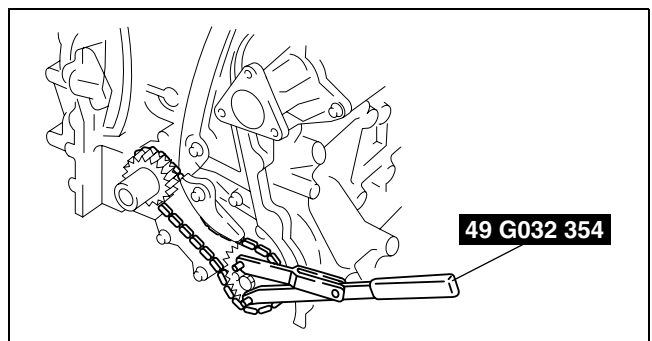
1. Hold the chain tensioner ratchet lock mechanism away from the ratchet stem with a thin screwdriver.
2. Slowly press the tensioner piston.
3. Hold the chain tensioner piston with a **1.5 mm {0.06 in}** wire or paper clip.



B3E0110E052

Oil Pump Sprocket Disassembly Note

1. Hold the oil pump sprocket using the **SST**.



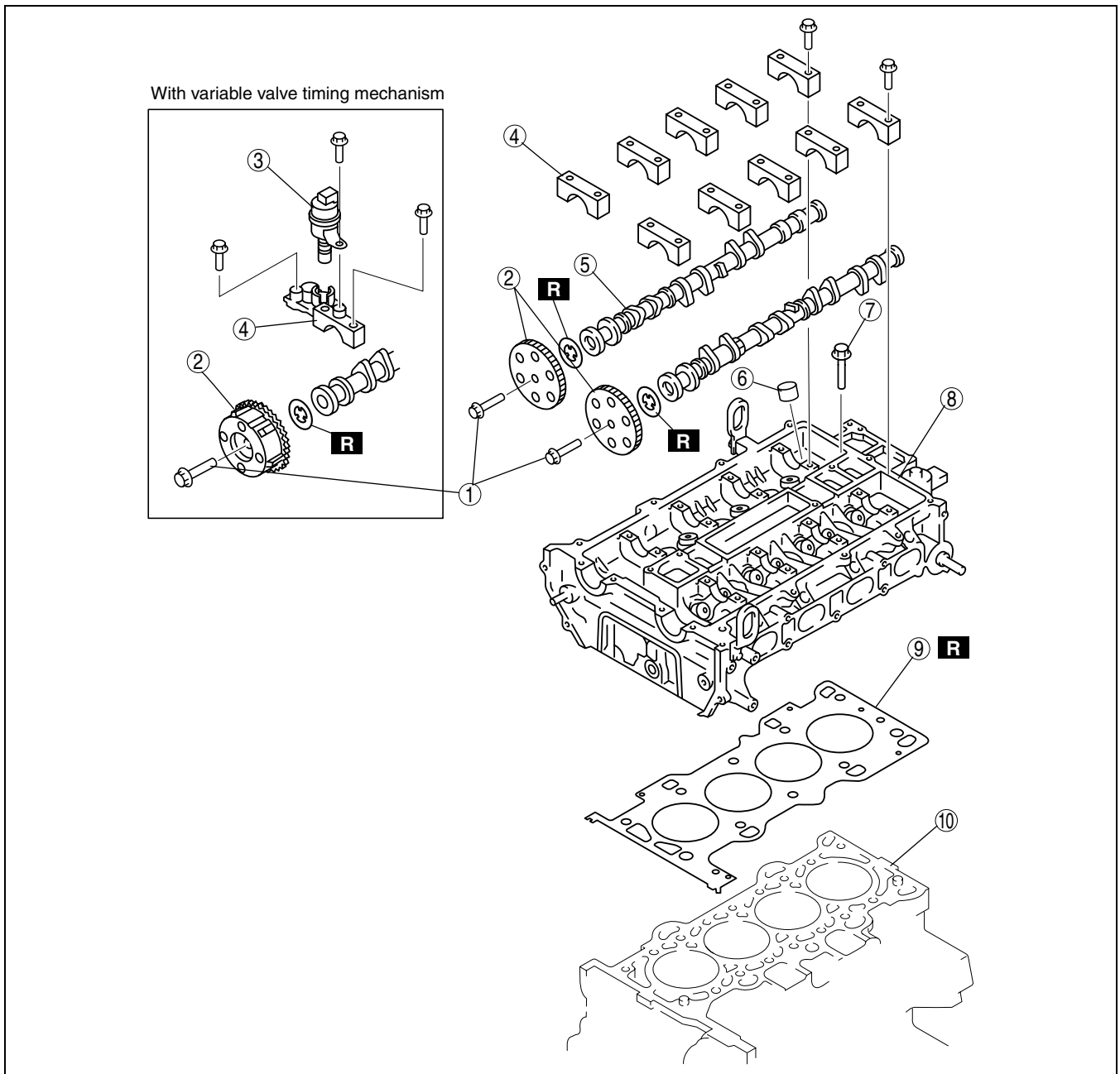
B3E0110E054

MECHANICAL

CYLINDER HEAD (I) DISASSEMBLY

B3E011002000204

1. Disassemble in the order indicated in the table.



D6E110ZE1013

1	Camshaft sprocket lock bolt, variable valve timing actuator lock bolt (With variable valve timing mechanism) (See 01-10-6 Camshaft Sprocket Lock Bolt, Variable Valve Timing Actuator Lock Bolt (With variable valve timing mechanism) Disassembly Note.)
2	Camshaft sprocket, variable valve timing actuator (With variable valve timing mechanism)
3	Oil control valve (OCV) (With variable valve timing mechanism)
4	Camshaft cap (See 01-10-6 Camshaft Cap Disassembly Note.)
5	Camshaft
6	Tappet (See 01-10-6 Tappet Disassembly Note.)

01

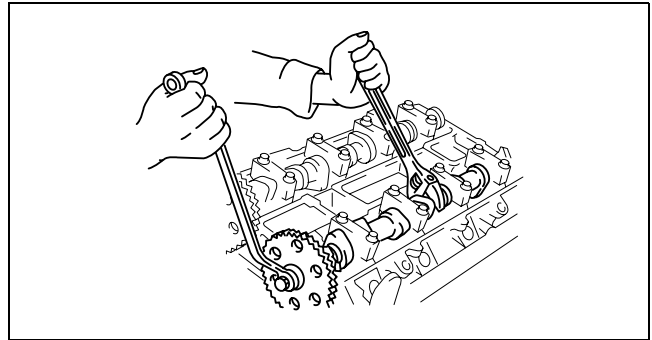
MECHANICAL

7	Cylinder head bolt (See 01-10-7 Cylinder Head Bolt Disassembly Note.)
8	Cylinder head
9	Cylinder head gasket
10	Cylinder block

Camshaft Sprocket Lock Bolt, Variable Valve Timing Actuator Lock Bolt (With variable valve timing mechanism) Disassembly Note

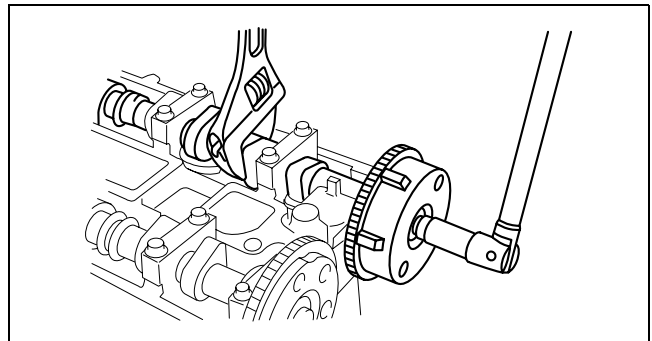
1. Hold the camshaft by using a wrench on the cast hexagon as shown, and loosen the camshaft sprocket installation bolt or variable valve timing actuator installation bolt (With variable valve timing mechanism).

Without variable valve timing mechanism.



B3E0110E056

With variable valve timing mechanism



B3E0110E057

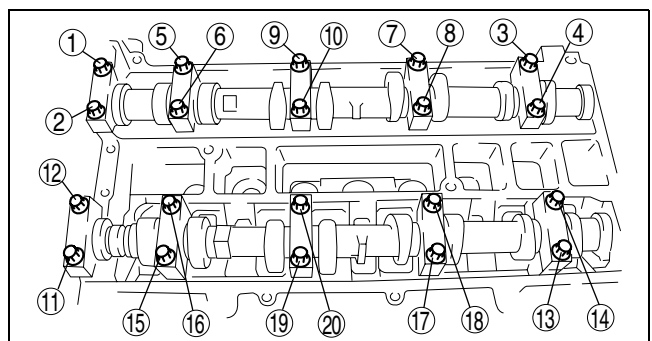
Camshaft Cap Disassembly Note

1. Before removing the camshaft caps, inspect the following:
 - Camshaft end play and camshaft journal oil clearance (See 01-10-15 CAMSHAFT INSPECTION.)

Note

- The camshaft caps are numbered to make sure they are assembled in their original positions. When removed, keep the caps with the cylinder head they were removed from. Do not mix the caps.

2. Loosen the camshaft caps bolts in 2—3 passes in the order shown in the figure.



B3E0110E057

Tappet Disassembly Note

Note

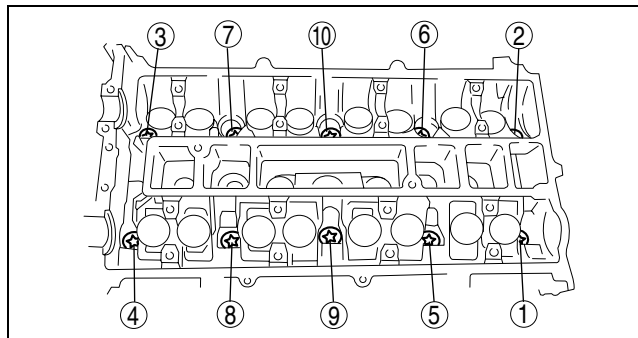
- The tappets are numbered to make sure they are assembled in their original positions. When removed,

MECHANICAL

keep the tappets with the cylinder head they were removed from. Do not mix the tappets.

Cylinder Head Bolt Disassembly Note

1. Loosen the cylinder head bolts in 2—3 passes in the order shown in the figure.

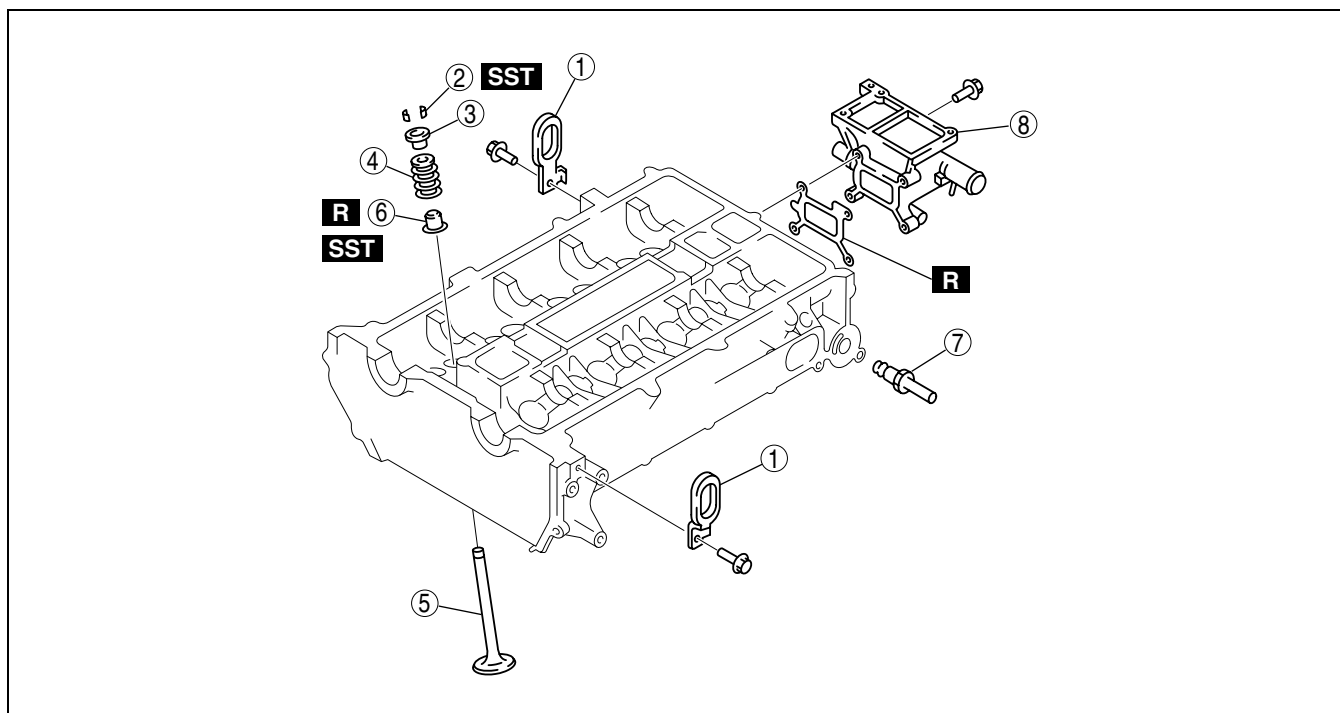


B3E0110E059

CYLINDER HEAD (II) DISASSEMBLY

1. Disassemble in the order indicated in the table.

B3E011002000214



B3E0110E060

1	Engine hanger
2	Valve keeper (See 01-10-7 Valve Keeper Disassembly Note.)
3	Upper valve spring seat
4	Valve spring

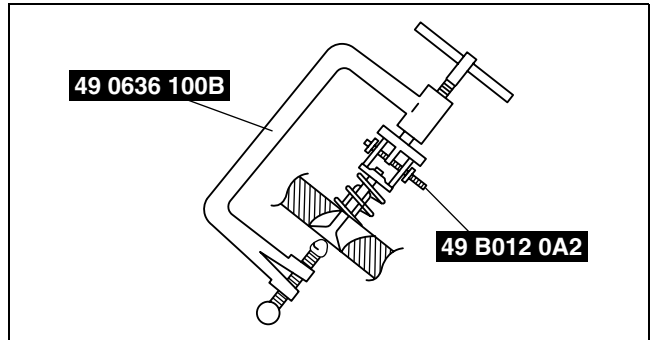
5	Valve
6	Valve seal (See 01-10-8 Valve Seal Disassembly Note.)
7	EGR pipe
8	Water outlet case

Valve Keeper Disassembly Note

1. Remove the valve keeper using the SSTs.

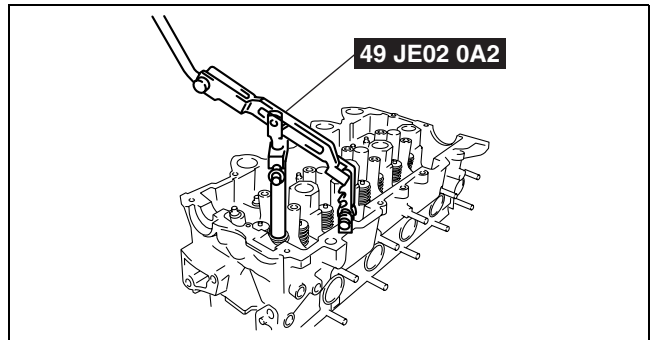
MECHANICAL

When using the SSTs (49 0636 100B, 49 B012 0A2)



B3E0110E124

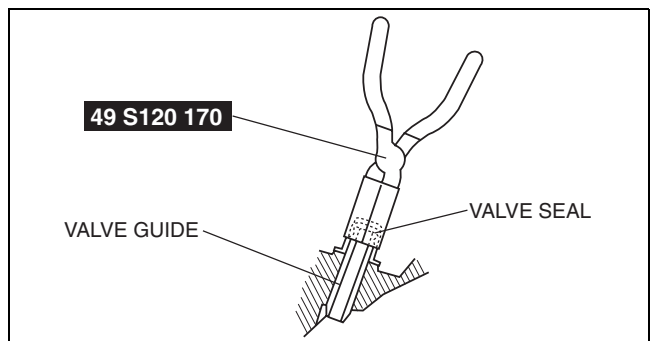
When using the SST (49 JE02 0A2) (Europe only)



CUE110ZER01

Valve Seal Disassembly Note

1. Remove the valve seal using the SST.



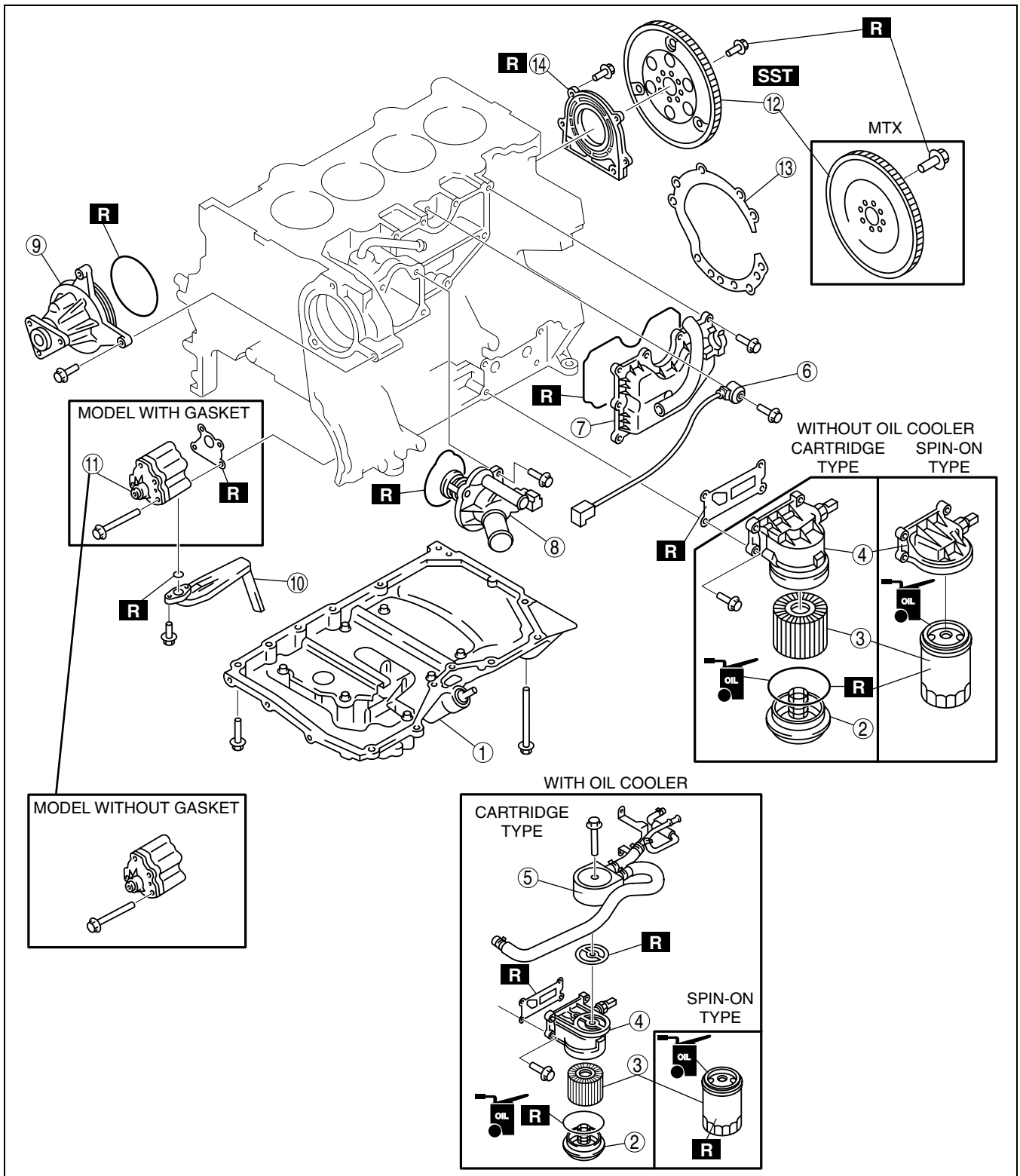
B3E0110E061

MECHANICAL

CYLINDER BLOCK (I) DISASSEMBLY

B3E011002000206

1. Disassemble in the order indicated in the table.



01

D6E110ZE1006

1	Oil pan
2	Oil filter cover (cartridge type)
3	Oil filter
4	Oil filter adapter
5	Oil cooler
6	Knock sensor
7	Oil separator

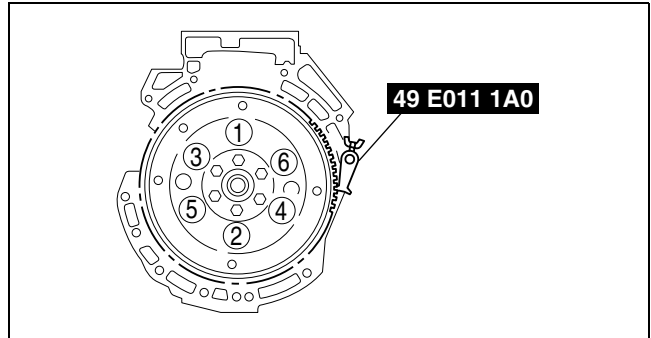
8	Thermostat
9	Water pump
10	Oil strainer
11	Oil pump
12	Flywheel (MTX), Drive plate (ATX) (See 01-10-10 Drive Plate (ATX), Flywheel (MTX) Disassembly Note)

MECHANICAL

13	End plate (MTX)
14	Rear oil seal

Drive Plate (ATX), Flywheel (MTX) Disassembly Note

1. Hold the crankshaft using the **SST**.
2. Remove the bolts in several passes.



B3E0110E051

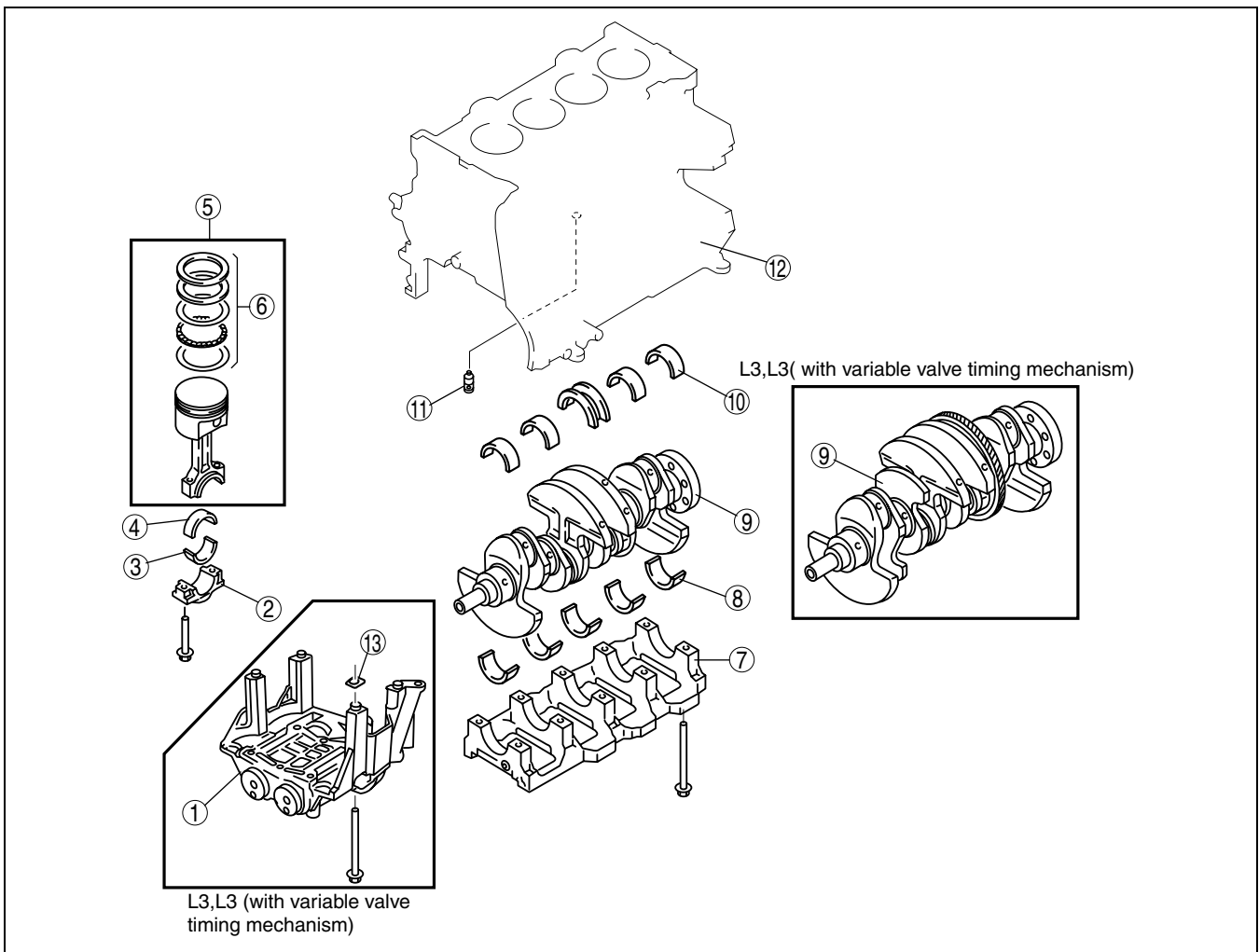
CYLINDER BLOCK (II) DISASSEMBLY

B3E011002000219

Note

- The internal parts of the cylinder block will not be available for the "TRIBUTE (L.H.D.) Face-lifted model" (Refer to TRIBUTE Workshop Manual for identifying Face-lifted model.)

1. Disassemble in the order indicated in the table.



D6E110ZE1007

1	Balancer unit (L3, L3 (with variable valve timing mechanism))
---	---

2	Connecting rod cap (See 01-10-11 Connecting Rod Cap Disassembly Note.)
---	---

MECHANICAL

3	Lower connecting rod bearing
4	Upper connecting rod bearing
5	Connecting rod, Piston component
6	Piston ring
7	Main bearing cap (See 01–10–11 Main Bearing Cap Disassembly Note.)
8	Lower main bearing, thrust bearing
9	Crankshaft
10	Upper main bearing, thrust bearing
11	Oil jet valve
12	Cylinder block
13	Adjustment shim

Connecting Rod Cap Disassembly Note

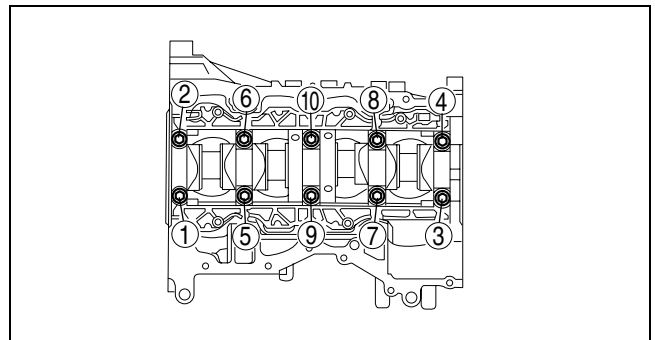
1. Before removing the connecting rod cap, inspect the connecting rod side clearance. (See 01–10–21 CONNECTING ROD INSPECTION.)
2. Remove the connecting rod bolt from the connecting rod cap by tapping the bolt with a plastic hammer.

Note

- Determine the position of each removed connecting rod cap.

Main Bearing Cap Disassembly Note

1. Before removing the main bearing cap, inspect the crankshaft end play. (See 01–10–19 CRANKSHAFT INSPECTION.)
2. Loosen the main bearing cap bolts in two or three steps in the order shown in the figure.



B3E0110E067

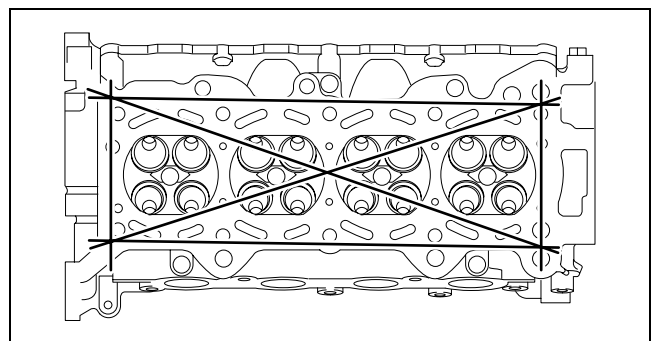
CYLINDER HEAD INSPECTION

1. Perform color contrast penetrate examination on the cylinder head surface.
 - Replace the cylinder head if necessary.
2. Inspect for the following and repair or replace if necessary.
 - (1) Sunken valve seats
 - (2) Excessive camshaft oil clearance and end play
3. Measure the cylinder head for distortion in six directions as shown in the figure.
 - If it exceeds the maximum specification, replace the cylinder head.

B3E0110100201

Maximum distortion:
0.10 mm {0.004 in}

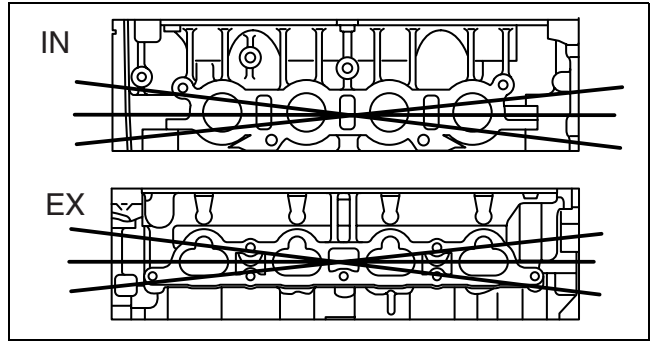
4. Measure the manifold contact surface distortion as shown in the figure.
 - If it exceeds the maximum specification, grind the surface or replace the cylinder head.



B3E0110E008

MECHANICAL

Maximum distortion:
0.10 mm {0.004 in}
Maximum grinding:
0.15 mm {0.006 in}



B3E0110E132

VALVE, VALVE GUIDE INSPECTION

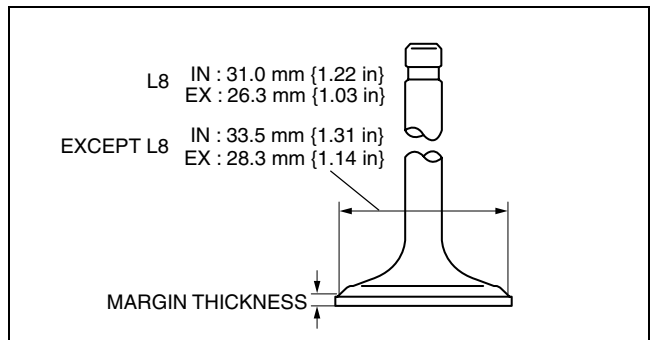
B3E011012111201

1. Measure the valve head margin thickness of each valve.
 - If it is less than the specification, replace the valve.

Margin thickness

IN: 1.62 mm {0.0637 in}
EX: 1.82 mm {0.0716 in}

2. Measure the length of each valve. Replace the valve if necessary.
 - If it is less than the specification, replace the valve.



D6E110ZE1008

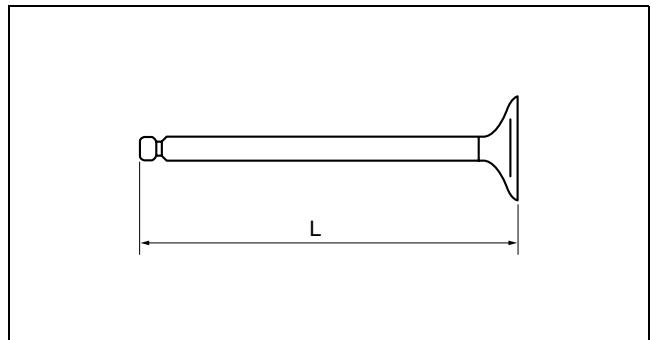
Standard length L

IN: 102.99—103.79 mm {4.055—4.086 in}
EX: 104.25—105.05 mm {4.105—4.135 in}

Minimum length L

IN: 102.99 mm {4.055 in}
EX: 104.25 mm {4.105 in}

3. Measure the stem diameter of each valve in X and Y directions at the three points (A, B, and C) as indicated in the figure.
 - If it exceeds the specification, replace the valve.



B3E0110E068

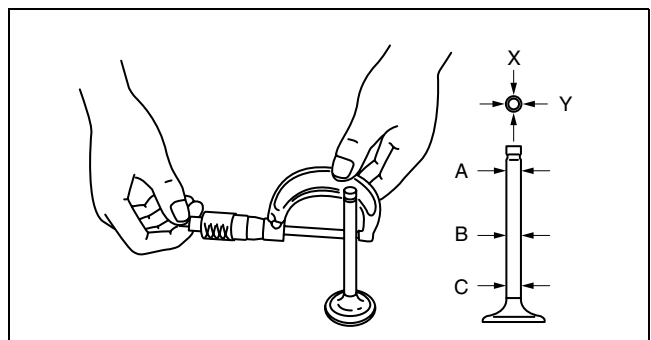
Standard diameter

IN: 5.470—5.485 mm {0.2154—0.2159 in}
EX: 5.465—5.480 mm {0.2152—0.2157 in}

Minimum diameter

IN: 5.470 mm {0.2154 in}
EX: 5.465 mm {0.2152 in}

4. Measure the inner diameter of each valve guide in X and Y directions at the three points (A, B, and C) as indicated in the figure.
 - If not as specified, replace the valve guide.



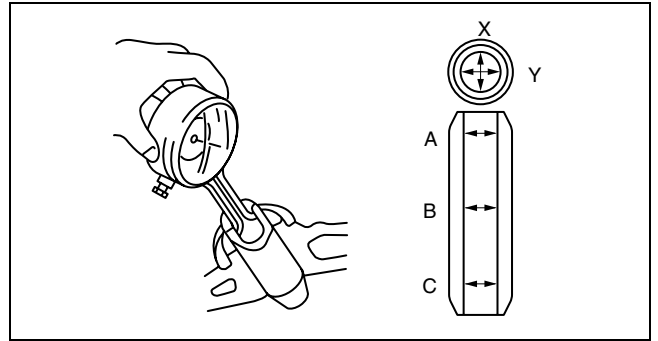
ADJ2224E024

MECHANICAL

Standard Inner diameter

5.509—5.539 mm {0.2169—0.2180 in}

- Calculate the valve stem to guide clearance by subtracting the outer diameter of the valve stem from the inner diameter of the corresponding valve guide.
 - If it exceeds the specification, replace the valve and/or the valve guide.



Standard clearance:

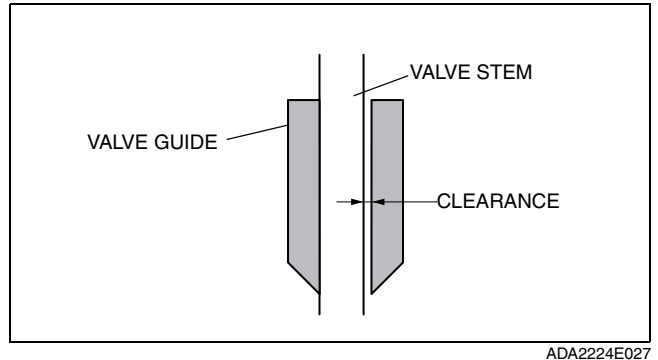
IN: 0.024—0.069 mm {0.0009—0.0027 in}

EX: 0.029—0.074 mm {0.0012—0.0029 in}

Maximum clearance:

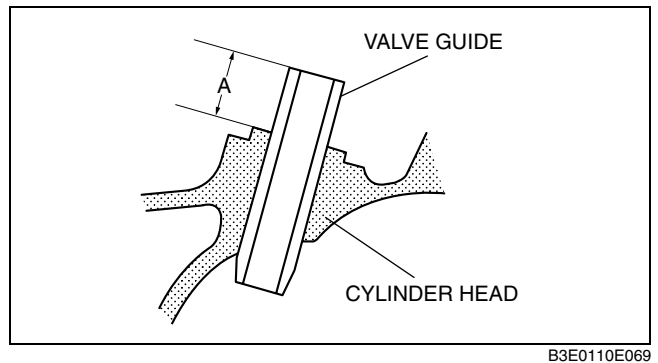
0.10 mm {0.004 in}

- Measure the protrusion height (dimension A) of each valve guide without lower valve spring seat.
 - If not within the specified, replace the valve guide.



Standard diameter:

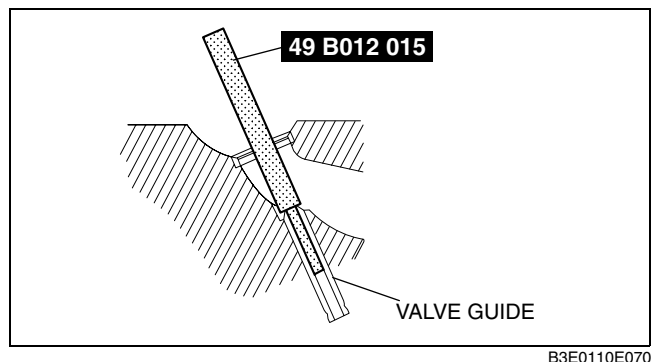
12.2—12.8 mm {0.481—0.503 in}



VALVE GUIDE REPLACEMENT

Valve Guide Removal

- Remove the valve guide from the combustion chamber side using the SST.



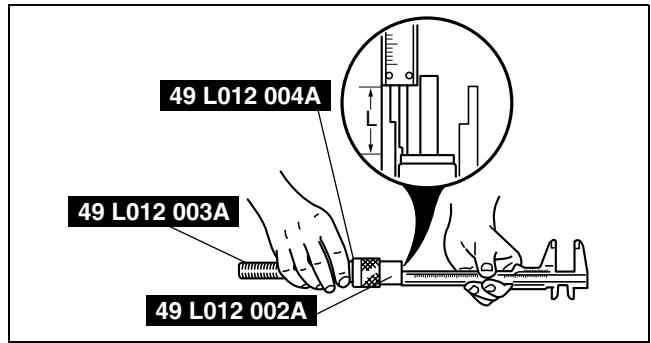
MECHANICAL

Valve Guide Installation

1. Assemble the **SSTs** so that depth L is as specified.

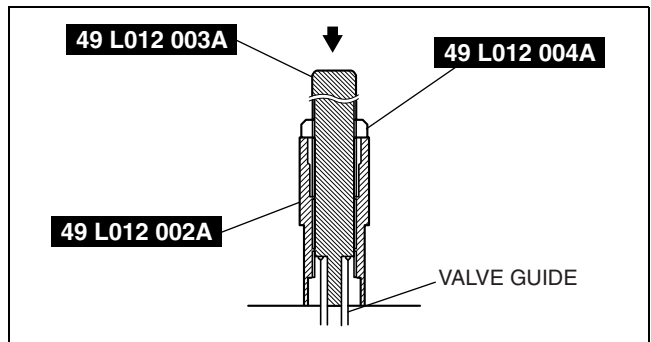
Depth L:

12.2—12.8 mm {0.481—0.503 in}



B3E0110E071

2. Tap the valve guide in from the cam side using the **SSTs** assembled in Step 1.

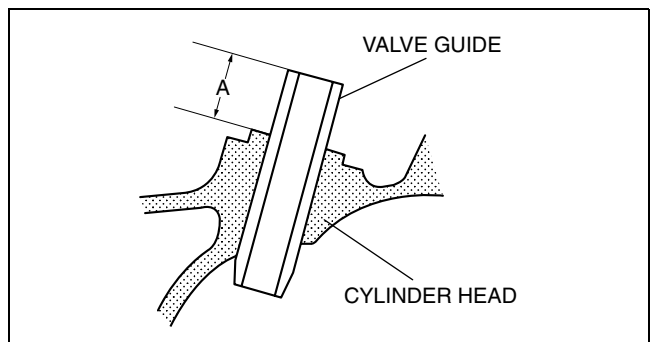


B3E0110E072

3. Verify that the valve guide projection height (dimension A) is within the specification.

Standard height:

12.2—12.8 mm {0.481—0.503 in}



B3E0110E069

VALVE SEAT INSPECTION/REPAIR

1. Measure the seat contact width.

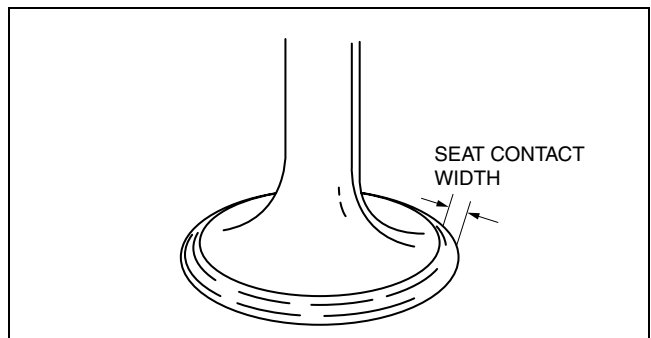
- If not within the specification, resurface the valve seat using a **45°** valve seat cutter and/or resurface the valve face.

Standard width:

1.2—1.6 mm {0.048—0.062 in}

2. Verify that the valve seating position is at the center of the valve face.

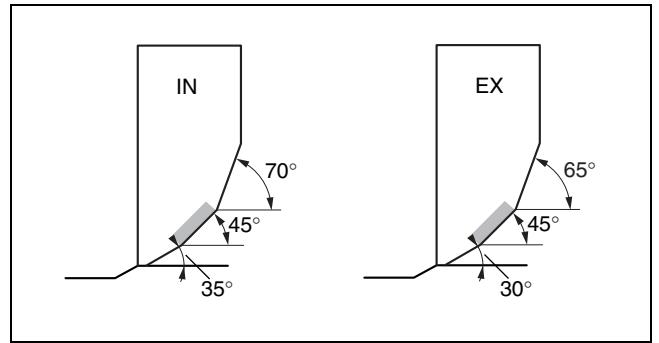
- (1) If the seating position is too out side, correct the valve seat using a **70°** (IN) or **65°** (EX) cutter, and a **45°** cutter.



ADA2224E019

MECHANICAL

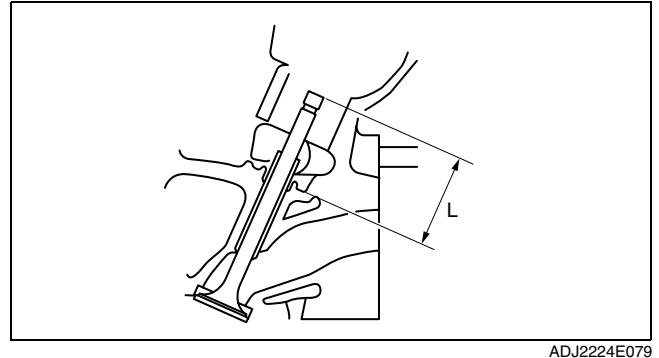
- (2) If the seating position is too inner side, correct the valve seat using a 35° (IN) cutter, and a 30° (EX) cutter, and a 45° cutter.
3. Inspect the sinking of the valve seat. Measure the protruding length (dimension L) of the valve stem.
 - If not specified, replace the cylinder head.



Standard dimension L:

IN: 40.64—42.24 mm {1.600—1.662 in}

EX: 40.50—42.10 mm {1.595—1.657 in}



VALVE SPRING INSPECTION

1. Apply pressing force to the pressure spring and inspect the spring height.
 - If it is less than the specification, replace the valve spring.

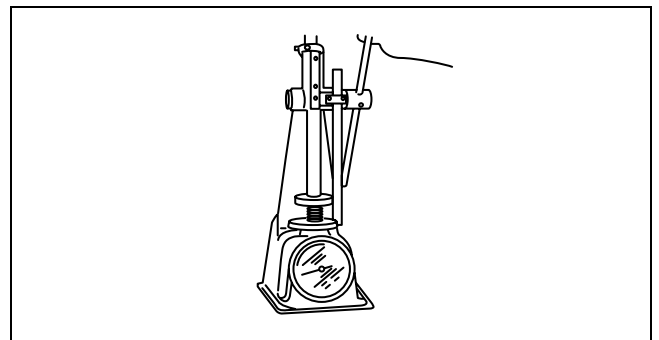
Pressing force

390 N {39.76 kgf, 87.67 lbf}

Standard height

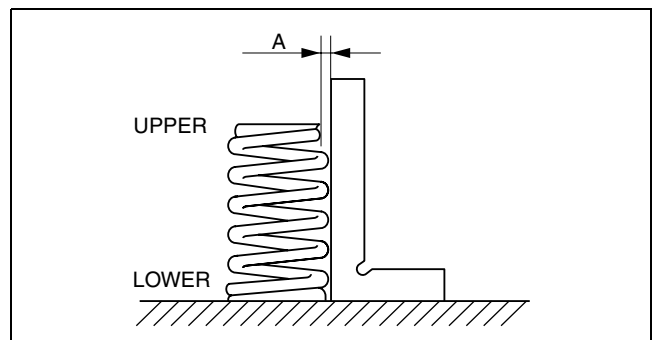
28.68 mm {1.129 in}

2. Measure the out-of-square of the valve spring, using a square, as shown in the figure.
 - (1) Rotate the valve spring one full turn and measure "A" at the point where the gap is the largest.
 - If it exceeds the specification, replace the valve spring.



Valve spring maximum out-of-square

1.95 mm {0.0767 in}



CAMSHAFT INSPECTION

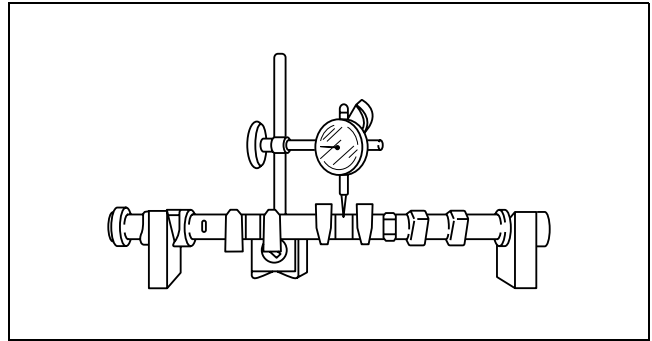
1. Set the No.1 and No.5 journals on V-blocks.
2. Measure the camshaft runout.
 - If it exceeds the specification, replace the camshaft.

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MECHANICAL

Maximum runout
0.03 mm {0.0012 in}

3. Measure the cam lobe height at the two points as shown in the figure.
 - If it is less than the specification, replace the camshaft.



B3E0110E074

Camshaft standard height (mm {in})
With variable valve timing mechanism
(LF,L3)

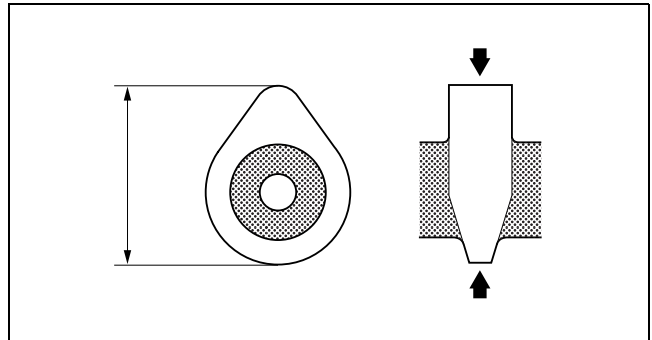
IN: 42.44 {1.671}
EX: 41.18 {1.621}

LF,L3

IN: 42.12 {1.659}
EX: 41.08 {1.618}

L8

IN: 40.79 {1.606}
EX: 41.08 {1.618}



B3E0110E076

Camshaft minimum height (mm {in})
With variable valve timing mechanism (LF,L3)

IN: 42.33 {1.666}
EX: 41.06 {1.616}

LF,L3

IN: 42.01 {1.653}
EX: 40.96 {1.612}

L8

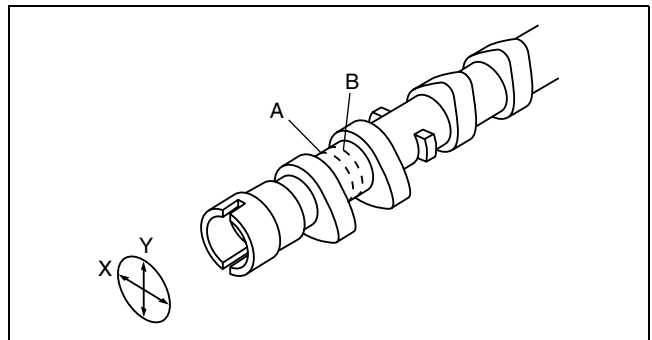
IN: 40.67 {1.601}
EX: 40.96 {1.612}

4. Measure the journal diameters in X and Y directions at the two points (A and B) as indicated in the figure.
 - If it is less than the specification, replace the camshaft.

Standard diameter
24.96—24.98 mm {0.9827—0.9834 in}

Minimum diameter
24.95 mm {0.982 in}

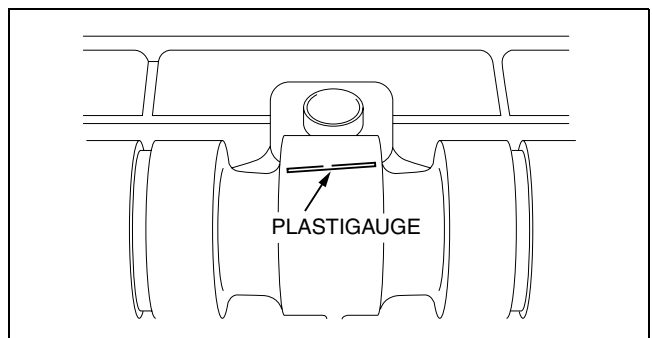
5. Remove the tappet.



B3E0110E075

6. Position a plastigauge atop the journals in the axial direction.
7. Install the camshaft cap. (See 01–10–39 Camshaft Assembly Note.)
8. Remove the camshaft cap. (See 01–10–6 Camshaft Cap Disassembly Note.)
9. Measure the oil clearance.
 - If it exceeds the specification, replace the cylinder head.

Standard clearance
0.04—0.08 mm {0.002—0.003 in}



B3E0110E077

MECHANICAL

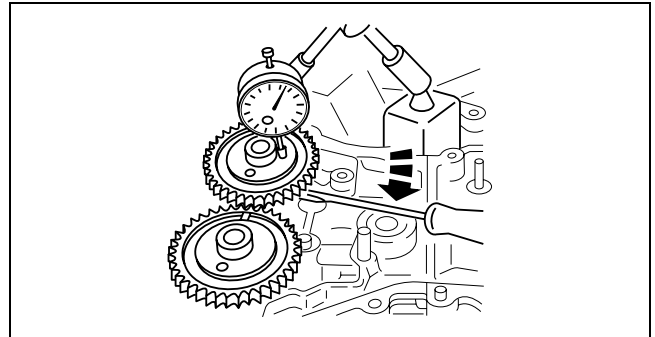
Maximum clearance
0.09 mm {0.0035 in}

10. Install the camshaft cap. (See 01-10-39 Camshaft Assembly Note.)
11. Measure the camshaft end play.
 - If it exceeds the specification, replace the cylinder head or camshaft.

Standard end play
0.09—0.24 mm {0.0035—0.0094 in}

Maximum end play
0.25 mm {0.0099 in}

12. Remove the camshaft cap. (See 01-10-6 Camshaft Cap Disassembly Note.)

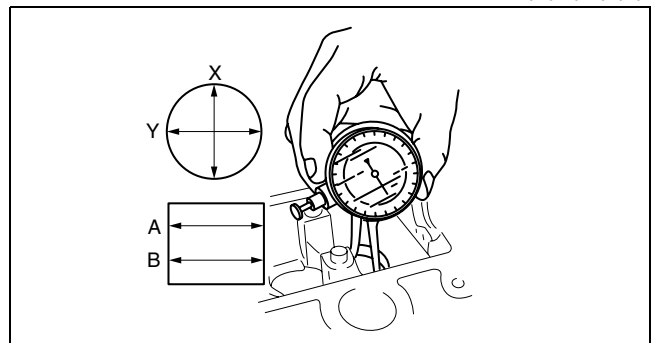


B3E0110E078

TAPPET INSPECTION

1. Measure the tappet hole inner diameter in X and Y directions at the two points (A and B) shown in the figure.

Inner diameter
31.000—31.030 mm {1.2205—1.2216 in}



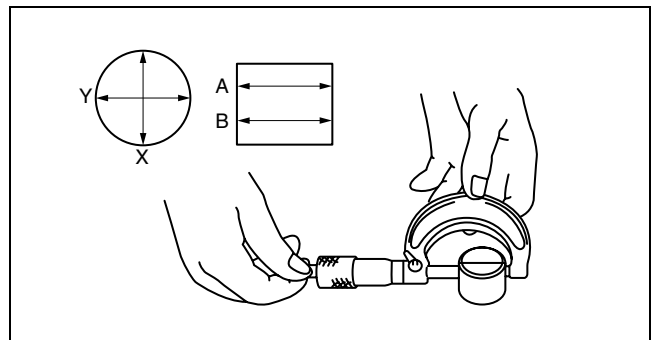
B3E011012310201

ADJ2224E023

2. Measure the tappet body outer diameter in X and Y directions at the two points (A and B) shown in the figure.

Outer diameter
30.970—30.980 mm {1.2193—1.2196 in}

3. Subtract the tappet body outer diameter from the tappet hole inner diameter.
 - If it exceeds the specification, replace the tappet or cylinder head.



ADJ2224E029

Standard clearance
0.02—0.06 mm {0.0008—0.0023 in}

Maximum clearance
0.15 mm {0.006 in}

CYLINDER BLOCK INSPECTION

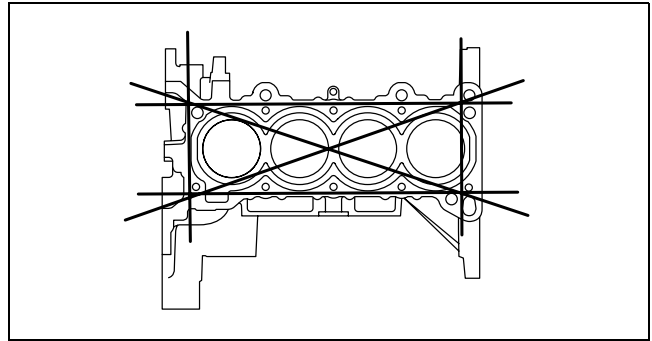
1. Measure the distortion of the cylinder block top surface in six directions as indicated in the figure.
 - If it exceeds the maximum, replace the cylinder block.

B3E011010300201

MECHANICAL

Maximum cylinder block distortion 0.10 mm {0.004 in}

2. Measure the cylinder bores in X and Y directions at **42 mm {1.65 in}** below the top surface.
 - If not within the specification, replace the cylinder block.



ADJ2224E089

Standard diameter limit

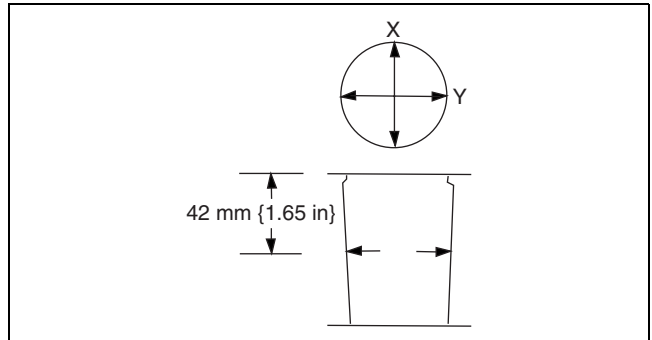
L8: 83.000—83.030 mm {3.2677—3.2689 in}

Except L8: 87.500—87.530 mm {3.4449—3.4460 in}

Minimum / maximum bore diameter limit

L8: 82.940—83.090 mm {3.2653—3.2712 in}

Except L8: 87.440—87.590 mm {3.4425—3.4484 in}



D6E110ZE1009

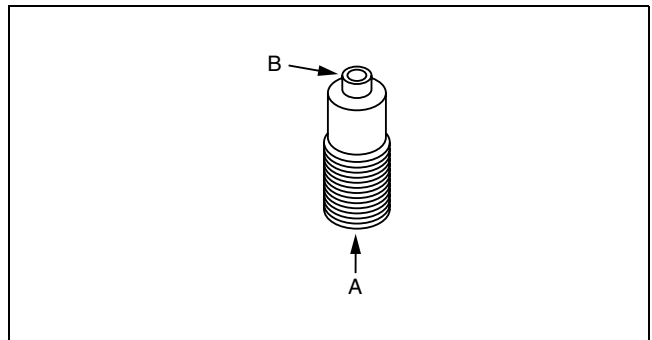
OIL JET VALVE INSPECTION

1. Apply compressed air to oil jet valve A and verify that air passes through oil jet valve B.
 - If air does not flow, replace the oil jet valve.

B3E011010730201

Air pressure

216—274 kPa {2.2—2.7 kgf·cm² 31.4—39.7 psi}



B3E0110E079

PISTON INSPECTION

B3E011011010201

Caution

- The piston, piston ring and connecting rod cannot be disassembled.
 - When replacing the piston, piston pin, piston ring and connecting rod, replace them together as a single unit.
1. Measure the outer diameter of each piston at right angle **90°** to the piston pin, **10.0 mm {0.40 in}** above the under of the piston.
 - If not within the specification, replace the piston, piston pin, piston ring and connecting rod as a single unit.

Piston diameter

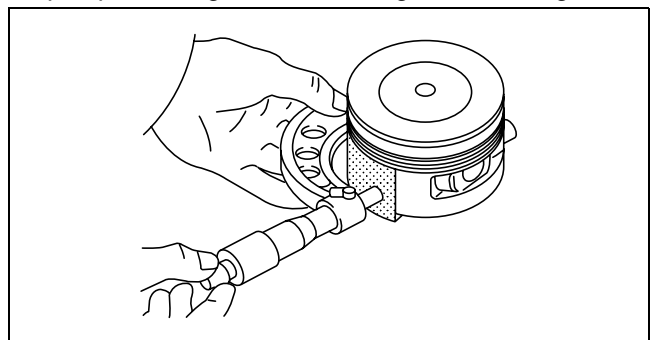
L8: 82.965—82.995 mm {3.2664—3.2675 in}

Except L8: 87.465—87.495 mm {3.4435—3.4446 in}

2. Measure the piston-to-cylinder clearance.
 - If not within the specification, replace the piston, piston pin, piston ring and connecting rod as a single unit.

Standard clearance

0.022—0.047 mm {0.0009—0.0018 in}



B3E0110E080

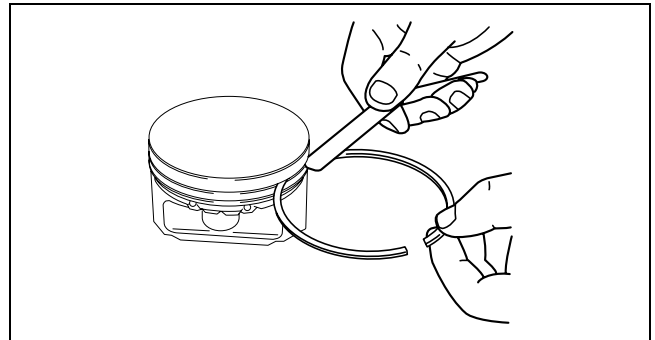
MECHANICAL

Maximum clearance
0.11 mm {0.0043 in}

3. Measure the piston ring-to-ring groove clearance around the entire circumference.
 - If it exceeds the specification, replace the piston, piston pin, piston ring and connecting rod as a single unit.

Standard clearance
Top: 0.04—0.08 mm {0.0016—0.0031 in}
Second: 0.03—0.07 mm {0.0012—0.0027 in}
Oil: 0.06—0.15 mm {0.0024—0.0059 in}

Maximum clearance
Top: 0.17 mm {0.0067 in}
Second, Oil: 0.15 mm {0.0059 in}

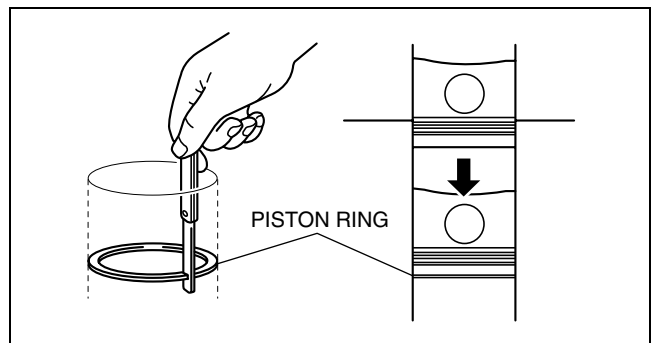


B3E0110E081

4. Insert the piston ring into the cylinder by hand and use the piston to push it to the bottom of the ring travel.
5. Measure each piston ring end gap with a feeler gauge.
 - If it exceeds the specification, replace the piston, piston pin, piston ring and connecting rod as a single unit.

Standard end gap
Top: 0.16—0.26 mm {0.0063—0.010 in}
Second: 0.33—0.48 mm {0.0130—0.0189 in}
Oil (rail): 0.20—0.70 mm {0.0079—0.0275 in}

Maximum end gap
1.0 mm {0.0393 in}



B3E0110E082

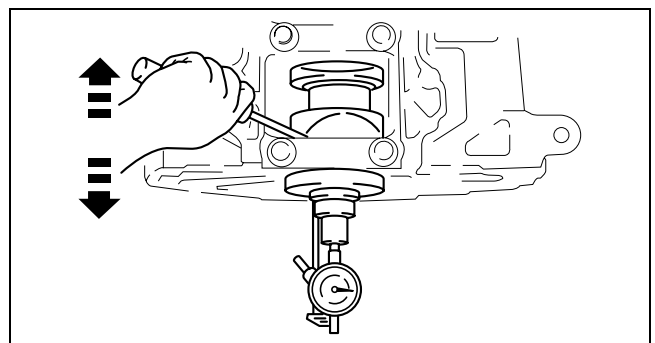
CRANKSHAFT INSPECTION

1. Install the main bearing cap. (See 01-10-28 Main Bearing Cap Assembly Note.)
2. Measure the crankshaft end play.
 - If it exceeds the specification, replace the thrust bearing or crankshaft so that the specified end play is obtained.

Standard end play
0.22—0.45 mm {0.0087—0.0177 in}

Maximum end play
0.55 mm {0.022 in}

3. Remove the main bearing cap. (See 01-10-6 Camshaft Cap Disassembly Note.)
4. Measure the crankshaft runout.
 - If it exceeds the specification, replace the crankshaft.

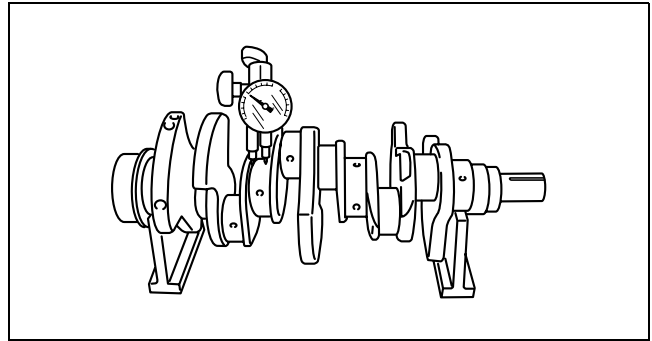


B3E0110E083

MECHANICAL

Maximum runout 0.05 mm {0.0019 in}

5. Measure the journal diameter in X and Y directions at the two points (A and B) as indicated in the figure.
 - If it exceeds the specification, replace the crankshaft or grind the journal and install the undersize bearing.



B3E0110E084

Main journal diameter

STD
51.980—52.000 mm {2.0465—2.0472 in}
US0.25
51.730—51.750 mm {2.0367—2.0374 in}

Maximum Main journal off-round
0.05 mm {0.0019 in}

Crank pin diameter

L8
STD: 46.980—47.000 mm {1.8497—1.8503 in}
US0.25: 46.730—46.750 mm {1.8398—1.8405 in}

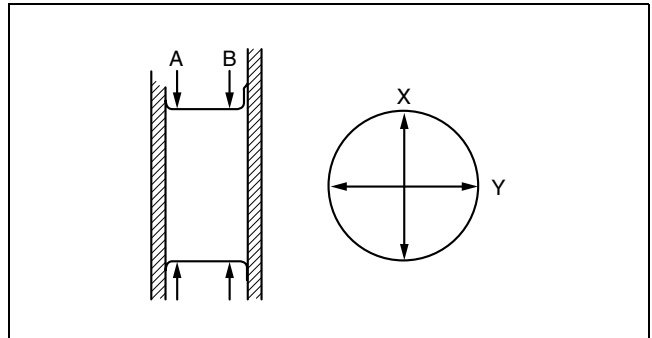
LF
STD: 46.980—47.000 mm {1.8497—1.8503 in}
US0.25: 46.730—46.750 mm {1.8398—1.8405 in}

LF (With variable valve timing mechanism)
STD: 46.980—47.000 mm {1.8497—1.8503 in}
US0.25: 46.730—46.750 mm {1.8398—1.8405 in}

L3
STD: 49.980—50.000 mm {1.9677—1.9685 in}
US0.25: 49.730—49.750 mm {1.9579—1.9586 in}

L3 (With variable valve timing mechanism)
STD: 49.980—50.000 mm {1.9677—1.9685 in}
US0.25: 49.730—49.750 mm {1.9579—1.9586 in}

Maximum Crank pin off-round
0.05 mm {0.0019 in}



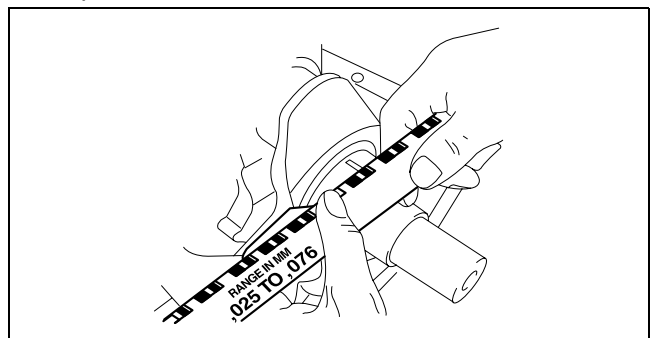
B3E0110E085

6. Install the main bearing caps and crankshaft.
7. Position a plastigauge atop the journals in the axial direction.
8. Install the main bearing caps and cylinder block. (See 01-10-28 Main Bearing Cap Assembly Note.)
9. Remove the main bearing caps. (See 01-10-6 Camshaft Cap Disassembly Note.)
10. Measure the main journal oil clearance.
 - If it exceeds the specification, replace the main bearing using the main bearing selection table or grind the main journal and install the oversize bearings so that the specified oil clearance is obtained.

Standard clearance
0.019—0.035 mm {0.0007—0.0013 in}

Maximum clearance
0.10 mm {0.0039 in}

Main bearing size
STD: 2.506—2.509
OS0.25: 2.506—2.509



B3E0110E086

MECHANICAL

CONNECTING ROD INSPECTION

B3E011011211201

Caution

- The piston, piston ring and connecting rod cannot be disassembled.
- When replacing the piston, piston pin, piston ring and connecting rod, replace them together as a single unit.

1. Install the connecting rod cap. (See 01-10-30 Connecting Rod Cap Assembly Note.)
2. Measure the connecting rod large end side clearance.
 - If it exceeds the specification, replace the piston, piston pin, piston ring and connecting rod as a single unit.

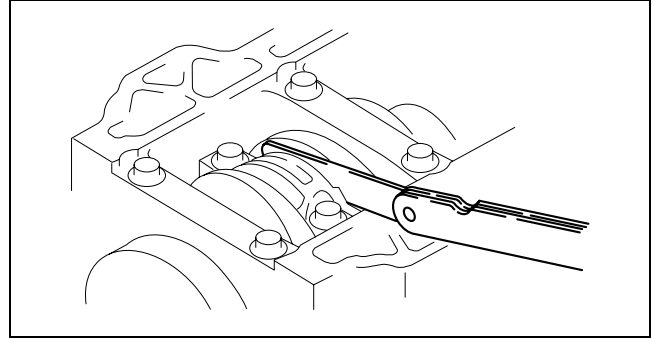
Standard clearance

0.14—0.36 mm {0.0056—0.0141 in}

Maximum clearance

0.435 mm {0.0172 in}

3. Remove the connecting rod cap.
4. Position plastigauge atop the journals in the axial direction.
5. Install the connecting rod bearing and connecting rod cap. (See 01-10-30 Connecting Rod Cap Assembly Note.)
6. Remove the connecting rod cap.
7. Measure the connecting rod oil clearance.
 - If it exceeds the specification, replace the connecting rod bearing or grind the crank pin and use oversize bearings so that the specified clearance is obtained.



B3E0110E087

Standard clearance

0.026—0.052 mm {0.0011—0.0020 in}

Maximum clearance

0.1 mm {0.0039 in}

Connecting rod bearing size

L8

STD: 1.498—1.504 mm {0.0589—0.0592 in}

OS0.25: 1.623—1.629 mm {0.0639—0.0641 in}

LF

STD: 1.498—1.504 mm {0.0589—0.0592 in}

OS0.25: 1.623—1.629 mm {0.0639—0.0641 in}

LF (With variable valve timing mechanism)

STD: 1.498—1.504 mm {0.0589—0.0592 in}

OS0.25: 1.623—1.629 mm {0.0639—0.0641 in}

L3

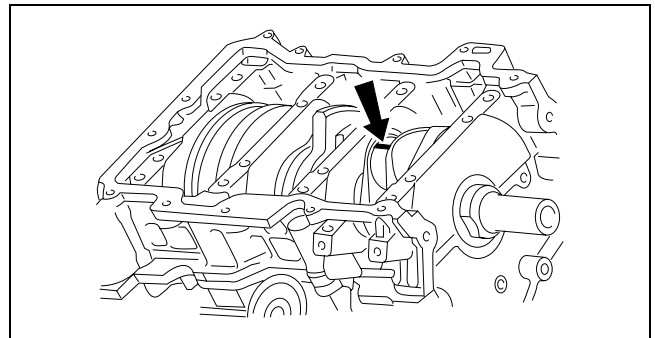
STD: 1.496—1.502 mm {0.0589—0.0591 in}

OS0.25: 1.621—1.627 mm {0.0639—0.0640 in}

L3 (With variable valve timing mechanism)

STD: 1.496—1.502 mm {0.0589—0.0591 in}

OS0.25: 1.621—1.627 mm {0.0639—0.0640 in}



B3E0110W128

BOLT INSPECTION

B3E011010135201

1. Measure the length of each bolt.
 - If it exceeds the specification, replace the bolt.

01

MECHANICAL

Bolt length (mm {in})

Cylinder head bolt (With washer)

Standard: 149.2—145.8 {5.87—5.90}

Maximum: 150.5 {5.91}

Cylinder head bolt (Without washer)

Standard: 145.2—145.8 {5.72—5.74}

Maximum: 146.5 {5.77}

Connecting rod bolt

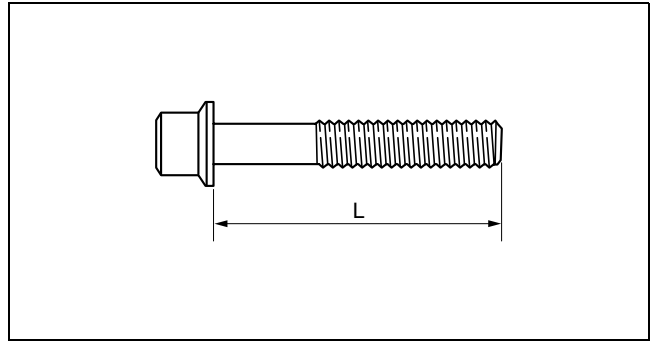
Standard: 44.7—45.3 {1.75—1.78}

Maximum: 46.0 {1.81}

Main bearing cap bolt (Plastic region tightening bolt only)

Standard: 110.0—110.6 {4.33—4.35}

Maximum: 113.3{4.38}



B3E0110E088

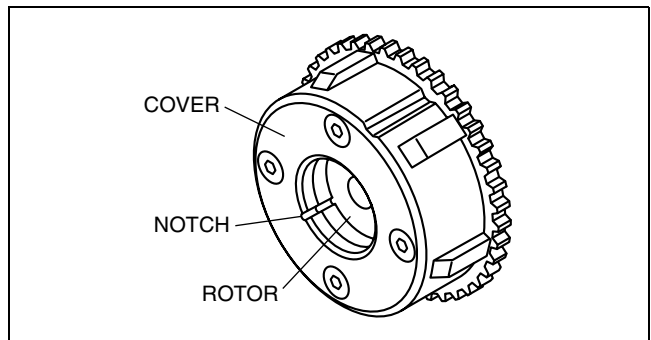
VARIABLE VALVE TIMING ACTUATOR INSPECTION

B3E011000142201

Caution

- Variable valve timing actuator cannot be disassembled because it is a precision unit.

1. Confirm that the groove of the rotor and notch of the cover at the variable valve timing actuator are aligned and fixed.
 - If the notch and the bump are not aligned, rotate the rotor toward the valve timing retard position by hand until they are in place.
 - If the rotor and cover are not fixed even though their notch and groove are aligned, replace the variable valve timing actuator.



B3E0110E089

OIL CONTROL VALVE (OCV) INSPECTION

B3E011014420201

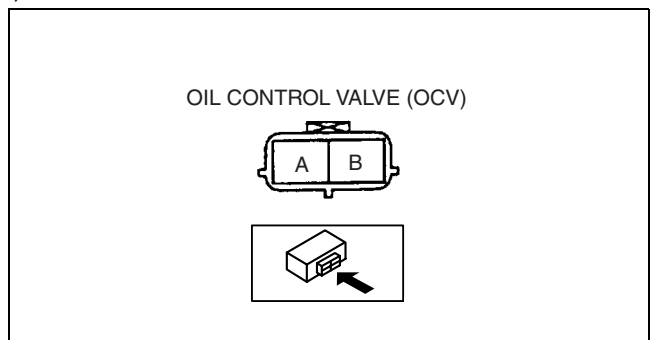
Coil resistance inspection

1. Disconnect the negative battery cable.
2. Disconnect the oil control valve (OCV) connector.
3. Measure the resistance between terminals A and B using an ohmmeter.
 - If not as specified, replace the oil control valve (OCV).

Specification

6.9—7.9 ohms [20 °C {68 °F}]

4. Connect the oil control valve (OCV) connector.



B3E2226W002

Spool valve operation inspection

1. Disconnect the negative battery cable.
2. Remove the oil control valve (OCV).
3. Verify that the spool valve in the oil control valve (OCV) is in the maximum valve timing retard position as

MECHANICAL

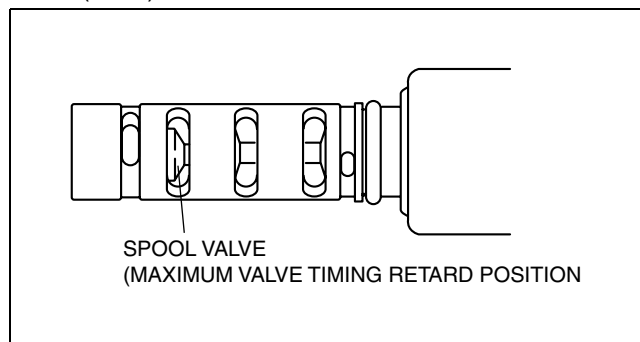
indicated in the figure.

- If it exceeds the specification, replace the oil control valve (OCV).
4. Verify that the battery is fully charged.
 - If it is less than specification, recharge the battery.
 5. Apply battery positive voltage between the oil control valve (OCV) terminals and verify that the spool valve operates and moves to the maximum valve timing advance position.
 - If it exceeds the specification, replace the oil control valve (OCV).

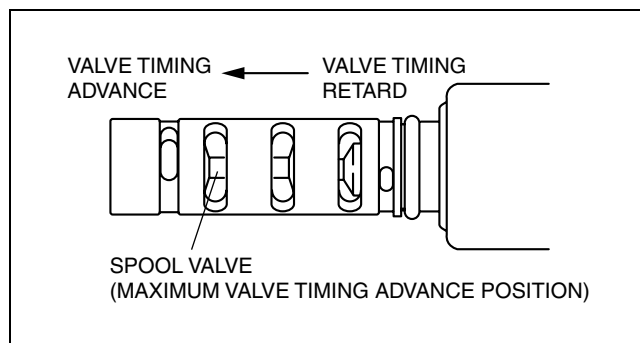
Note

- When applying battery positive voltage between the oil control valve (OCV) terminals, the connection can be either of the following:
 - Positive battery cable to terminal A, negative battery cable to terminal B
 - Positive battery cable to terminal B, negative battery cable to terminal A

6. Stop applying battery positive voltage and verify that the spool valve returns to the maximum valve timing retard position.
 - If it exceed the specification, replace the oil control valve (OCV).



B3E0110E090



B3E0110E091

VALVE CLEARANCE INSPECTION

1. Measure the valve clearance as follows.
 - (1) Turn the crankshaft clockwise so that the No.1 piston is at TDC of the compression stroke.
 - (2) Measure the valve clearance at A in the figure.
 - If the valve clearance exceeds the standard, replace the tappet. (See 01-10-24 VALVE CLEARANCE ADJUSTMENT.)

Note

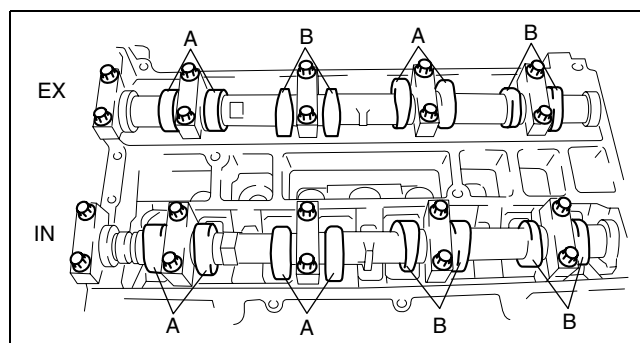
- Make sure to note the measured values for choosing the suitable replacement tappets.

Standard [Engine cold]

IN: 0.22—0.28 mm {0.0087—0.0110 in}

EX: 0.27—0.33 mm {0.0106—0.0130 in}

- (3) Turn the crankshaft 360° clockwise so that the No.4 piston is at TDC of the compression stroke.
- (4) Measure the valve clearance at B in the figure.
 - If the valve clearance exceeds the standard, replace the tappet. (See 01-10-24 VALVE CLEARANCE ADJUSTMENT.)



B3E0110E092

Note

- Make sure to note the measured values for choosing the suitable replacement tappets.

Standard [Engine cold]

IN: 0.22—0.28 mm {0.0087—0.0110 in}

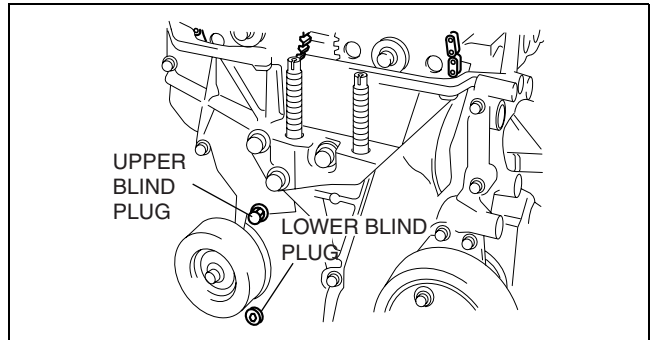
EX: 0.27—0.33 mm {0.0106—0.0130 in}

MECHANICAL

VALVE CLEARANCE ADJUSTMENT

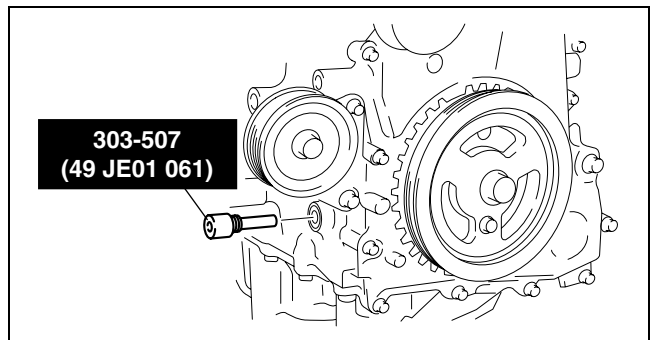
B3E011012111204

1. Remove the engine front cover lower blind plug.
2. Remove the engine front cover upper blind plug.
3. Remove the cylinder block lower blind plug.



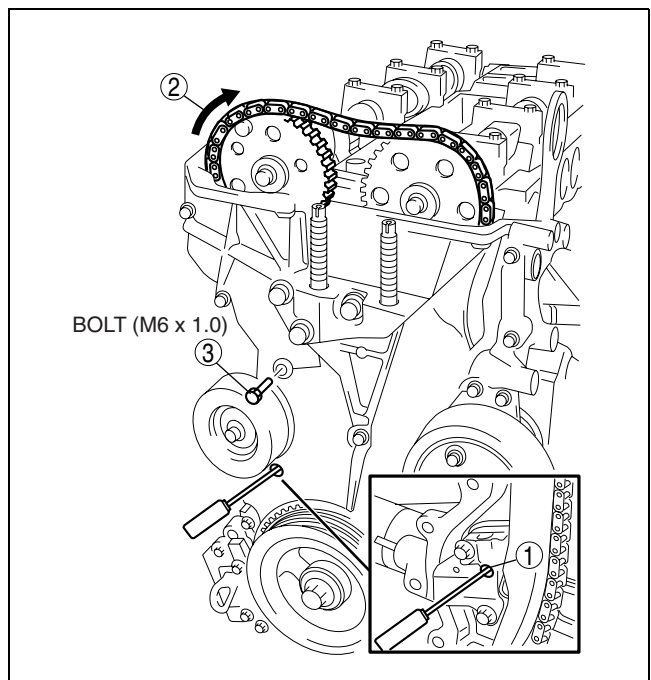
B3E0110E093

4. Install the **SST** as shown in the figure.
5. Turn the crankshaft clockwise so that the crankshaft is in the No.1 cylinder TDC position.
6. Loosen the timing chain.



B3E0110E094

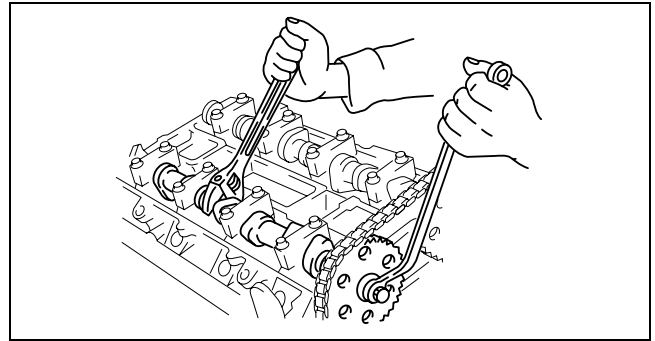
- (1) Using a suitable screwdriver or equivalent tool, unlock the chain tensioner ratchet.
- (2) Turn the exhaust camshaft clockwise using a suitable wrench on the cast hexagon and loosen the timing chain.
- (3) Placing the suitable bolt (**M6 × 1.0 Length 25—35 mm {0.9—1.3 in}**) at the engine front cover upper blind plug hole, secure the chain guide at the position where the tension is released.



B3E0110E096

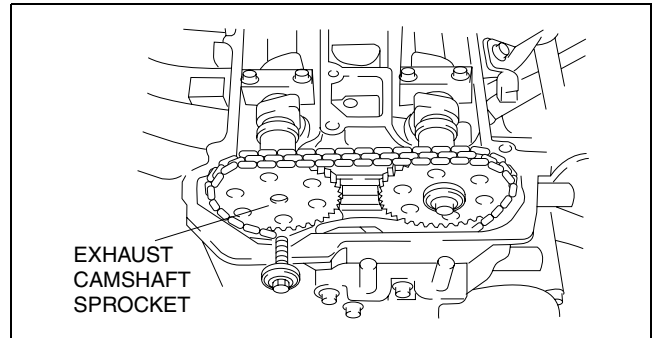
MECHANICAL

7. Hold the exhaust camshaft using a suitable wrench on the cast hexagon as shown in the figure.



B3E0110E095

8. Remove the exhaust camshaft sprocket.

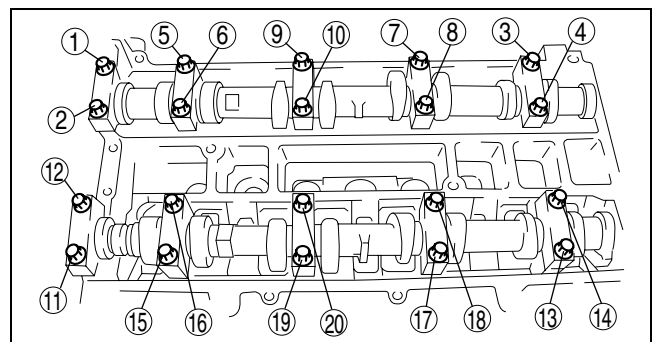


B3E0110E097

9. Loosen the camshaft cap bolts in several passes in the order shown in the figure.

Note

- The cylinder head and the camshaft caps are numbered to make sure they are reassembled in their original position. When removed, keep the caps with the cylinder head they were removed from. Do not mix the caps.



B3E0110E057

10. Remove the camshaft.
11. Remove the tappet.
12. Select proper adjustment shim.

New adjustment shim

= Removed shim thickness + Measured valve clearance - Standard valve clearance (IN: 0.25 mm {0.0098 in}, EX: 0.30 mm {0.0118 in})

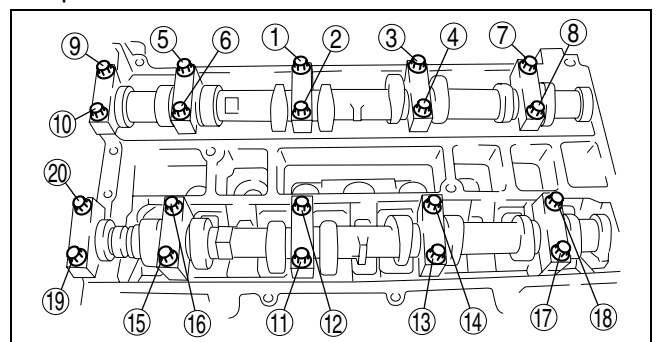
Standard [Engine cold]

IN: 0.22—0.28 mm {0.0087—0.0110 in}
EX: 0.27—0.33 mm {0.0106—0.0130 in}

13. Install the camshaft with No.1 cylinder aligned with the TDC position.
14. Tighten the camshaft cap bolt using the following two steps.

Tightening torque

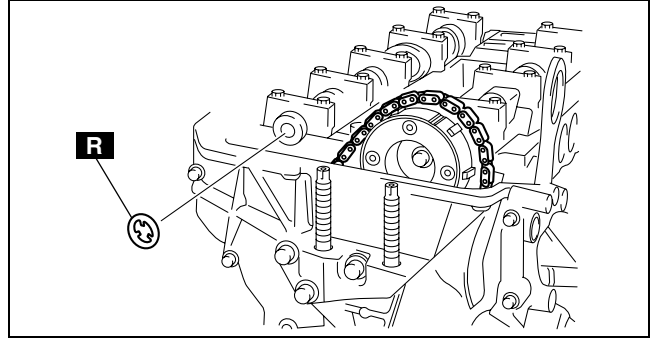
- (1) 5.0—9.0 N·m
{51.0—91.7 kgf·cm, 44.3—79.5 in·lbf}
(2) 14.0—17.0 N·m
{1.43—1.73 kgf·m, 10.4—12.5 ft·lbf}



B3E0110E098

MECHANICAL

15. Install a new washer.



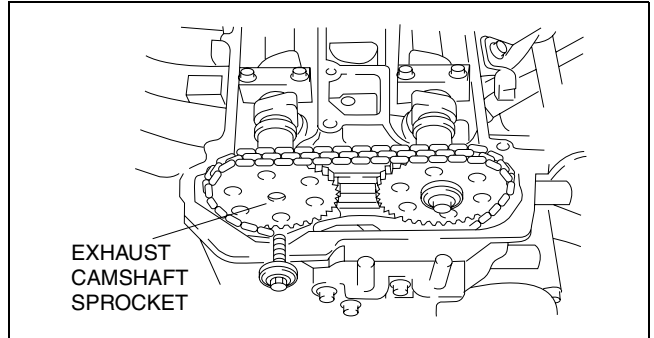
E6U110ZWB020

16. Install the exhaust camshaft sprocket.

Note

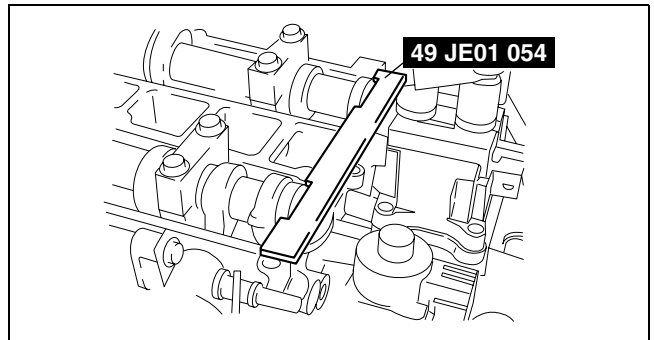
- Do not tighten the bolt for the camshaft sprocket during this step. First confirm the valve timing, then tighten the bolt.

17. Install the **SST** to the camshaft as shown in the figure.



B3E0110E097

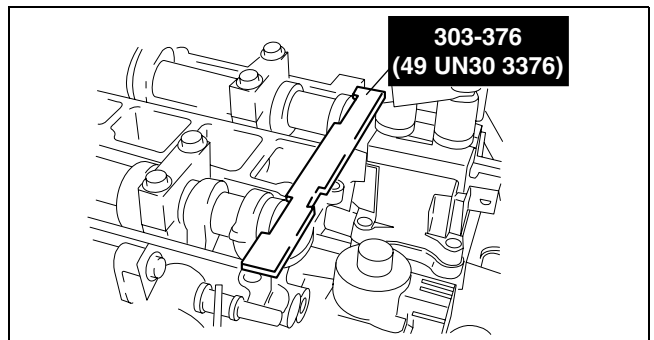
Europe



B3E0110E099

Except Europe

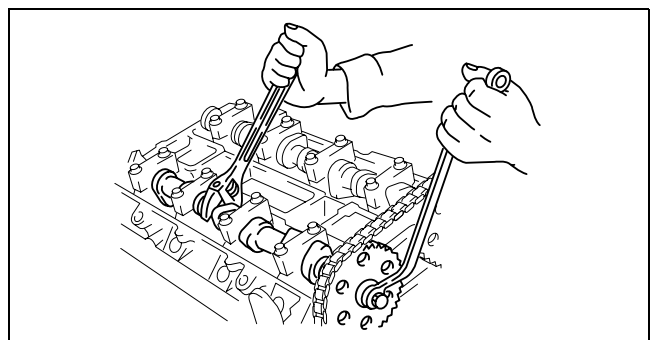
- Remove the M6 × 1.0 bolt from the engine front cover to apply tension to the timing chain.
- Turn the crankshaft clockwise so that the crankshaft is in the No.1 cylinder TDC position.



B3E0110E100

20. Hold the exhaust camshaft using a suitable wrench on the cast hexagon as shown in the figure.

21. Tighten the exhaust camshaft sprocket lock bolt.



B3E0110E095

N·m {kgf·m, ft·lbf}

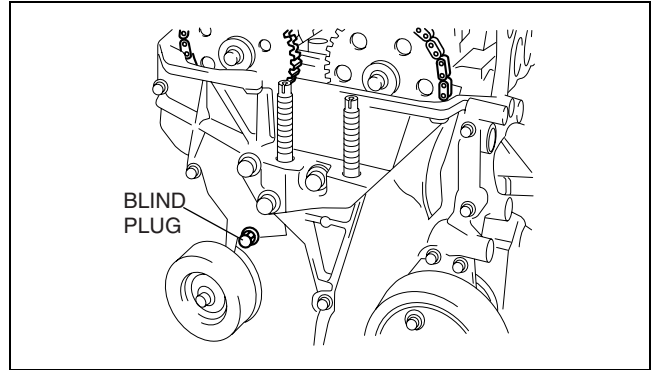
Bolt type	Tightening torque
Bolt and washer assembly	69—75 {7.1—7.6, 50.9—55.3}
Washer based bolt	89—95 {9.1—9.6, 65.7—70.0}

MECHANICAL

Bolt type	Tightening torque
Washer based bolt for variable valve timing mechanism	69—75 {7.1—7.6, 50.9—55.3}

22. Remove the **SST** from the camshaft.
23. Remove the **SST** from the block lower blind plug.
24. Rotate the crankshaft clockwise two turns until the TDC position.
 - If not aligned, loosen the crankshaft pulley lock bolt and repeat from Step 14.
25. Apply silicone sealant to the engine front cover upper blind plug.
26. Install the engine front cover upper blind plug.

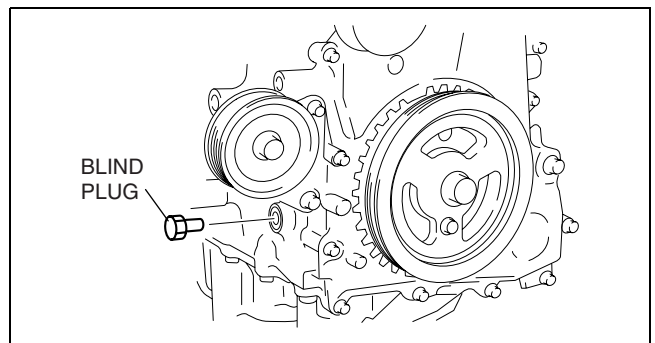
Tightening torque
10 N·m {1.0 kgf·m, 7.4 ft·lbf}



B3E0110E101

27. Install the cylinder block lower blind plug.

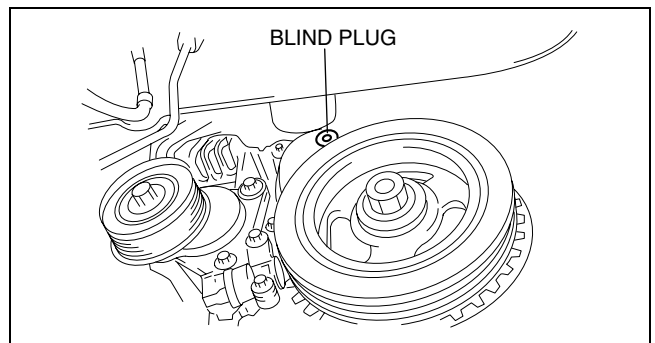
Tightening torque
20 N·m {2.0 kgf·m, 14.8 ft·lbf}



B3E0110E102

28. Install the new engine front cover lower blind plug.

Tightening torque
12 N·m {1.2 kgf·m, 8.9 ft·lbf}



B3E0110E103

CYLINDER BLOCK (I) ASSEMBLY

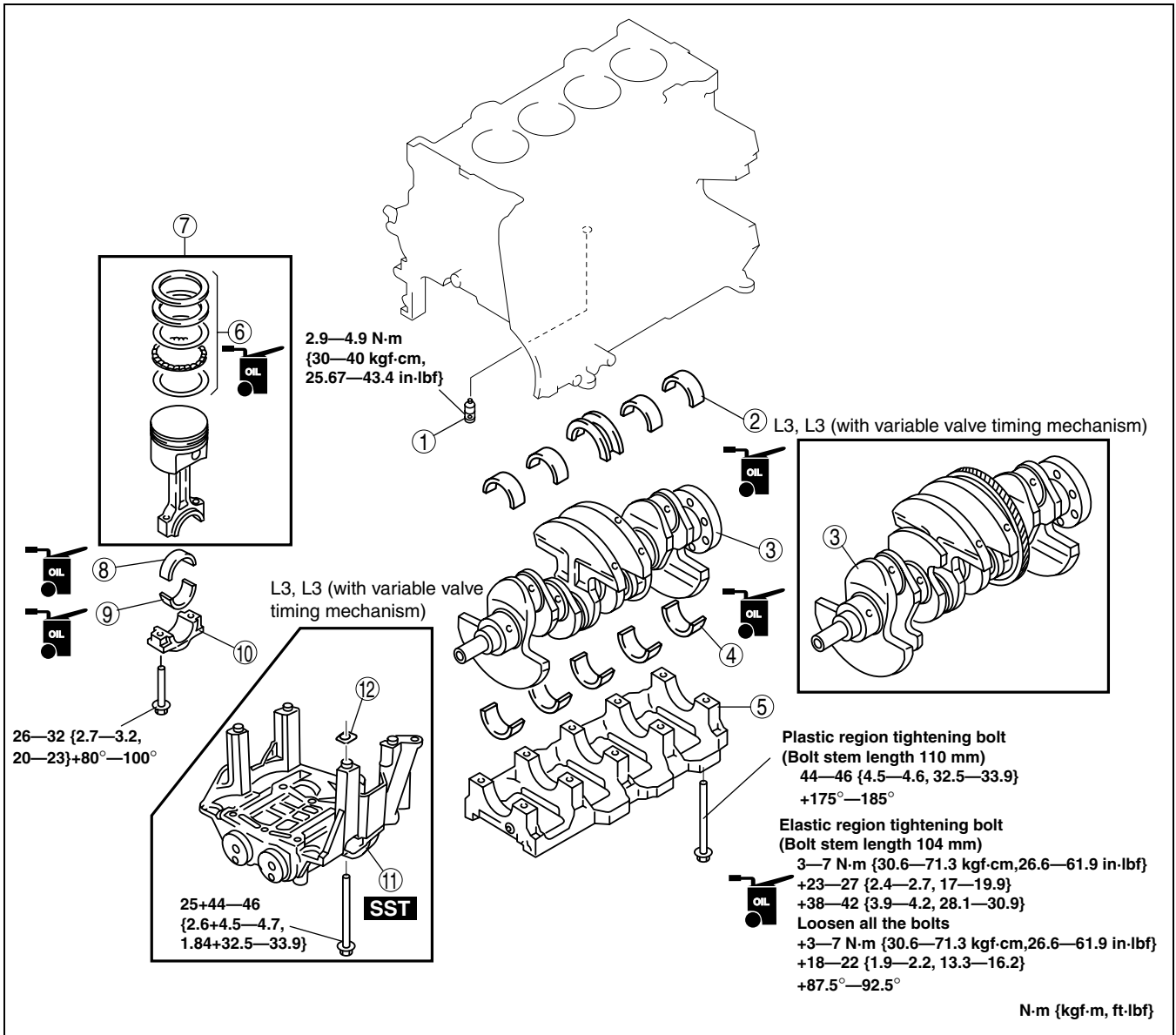
B3E011002000220

Note

- The internal parts of the cylinder block will not be available for the "TRIBUTE (L.H.D.) Face-lifted model" (Refer to TRIBUTE Workshop Manual for identifying Face-lifted model.)

MECHANICAL

1. Assemble in the order indicated in the table.



D6E110ZE1002

1	Oil jet valve
2	Upper main bearing, thrust bearing
3	Crankshaft
4	Lower main bearing, thrust bearing
5	Main bearing cap (See 01-10-28 Main Bearing Cap Assembly Note)
6	Piston ring (See 01-10-29 Piston Ring Assembly Note)
7	Connecting rod, piston assembly (See 01-10-29 Piston Assembly Note)

8	Upper connecting rod bearing (See 01-10-30 Connecting Rod Bearing Assembly Note)
9	Lower connecting rod bearing (See 01-10-30 Connecting Rod Bearing Assembly Note)
10	Connecting rod cap (See 01-10-30 Connecting Rod Cap Assembly Note)
11	Engine balancer (L3 (with variable valve timing mechanism)) (See 01-10-30 Balancer Unit Assembly Note)
12	Adjustment shim

Main Bearing Cap Assembly Note

1. Install the main bearing caps in the order indicated in the figure.

Tightening torque

Plastic region tightening bolt (Bolt stem length 110 mm)

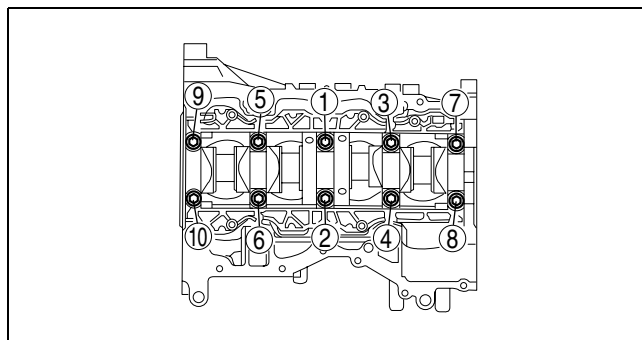
(1) 44-46 N·m {4.5-4.6 kgf·m, 32.5-33.9 ft·lbf}

(2) 175°-185°

MECHANICAL

Elastic region tightening bolt (Bolt stem length 104 mm)

- (1) Apply engine oil to all bolts.
- (2) 3—7 N·m {30.6—71.3 kgf·cm, 26.6—61.9 in·lbf}
- (3) 23—27 N·m {2.4—2.7 kgf·m, 17—19.9 ft·lbf}
- (4) 38—42 N·m {3.9—4.2 kgf·m, 28.1—30.9 ft·lbf}
- (5) Loosen all the bolts. (no remaining torque.)
- (6) 3—7 N·m {30.6—71.3 kgf·cm, 26.6—61.9 in·lbf}
- (7) 18—22 N·m {1.9—2.2 kgf·m, 13.3—16.2 ft·lbf}
- (8) 87.5°—92.5°

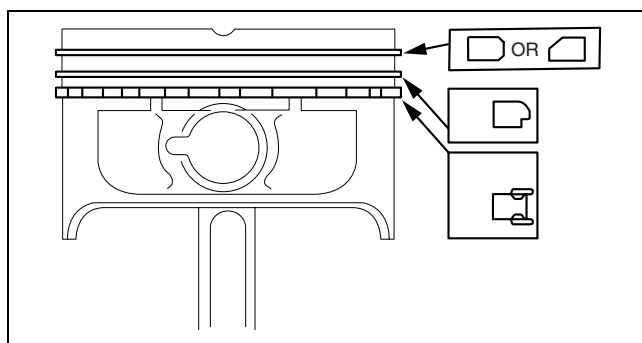


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01

Piston Ring Assembly Note

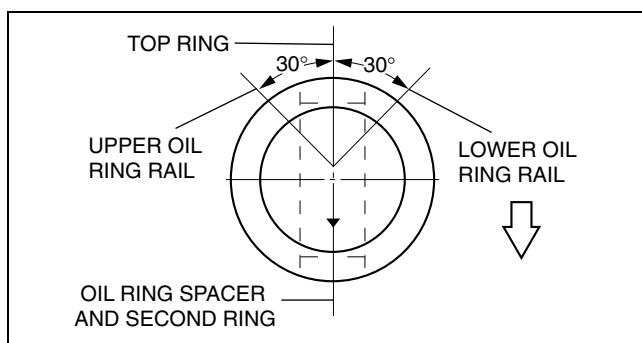
1. Install the two oil control ring segments and spacer.
2. Verify that the second ring is installed with scraper face side downward.
3. Verify that the top ring is installed with scraper face side inner of upper.



D6E110ZE1K014

Piston Assembly Note

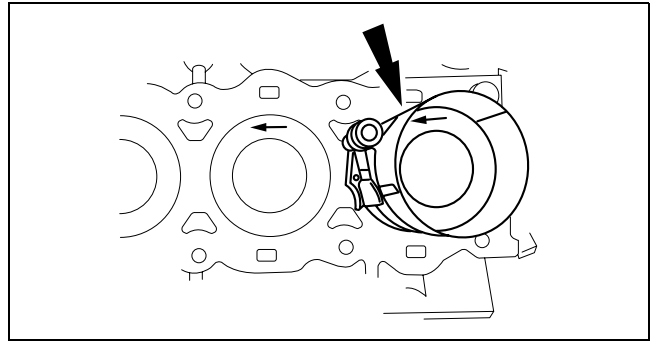
1. Position the end gap of each ring as indicated in the figure.



B3E0110E107

MECHANICAL

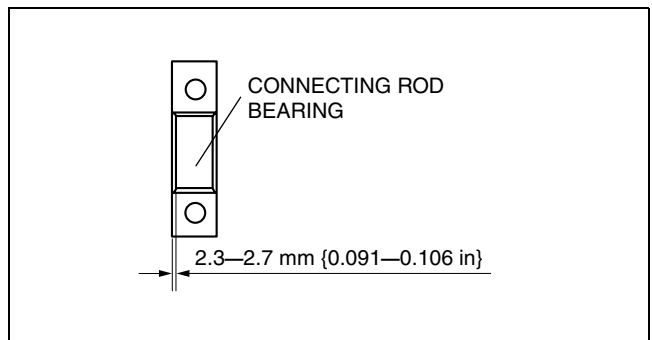
2. Insert the piston and connecting rod into the cylinder with the arrow mark to front of the engine.



B3E0110E108

Connecting Rod Bearing Assembly Note

1. Install the connecting rod bearing to the connecting rod and connecting rod caps, as shown in the figure.



B3E0110E109

Connecting Rod Cap Assembly Note

Caution

- When assembling the connecting rod caps, align the broken, rough faces of the connecting rods and connecting rod caps.

1. Tighten the connecting rod bolts in two steps using the **SST (49 D032 316)**.

Tightening torque

- (1) 26—32 N·m
{2.7—3.2 kgf·m, 19.2—23.6 ft·lbf}
- (2) 80°—100°

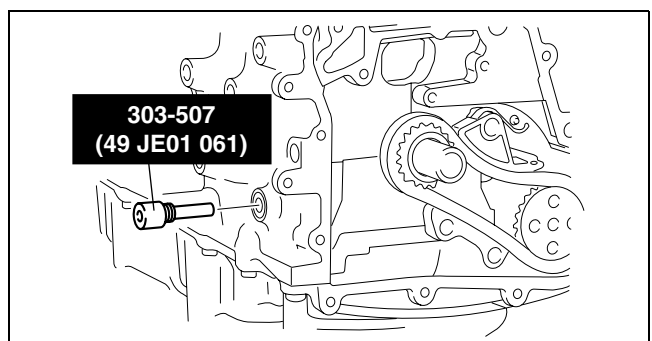
Balancer Unit Assembly Note

1. Confirm by visual inspection that there is no damage to the balancer unit gear and verify that the shaft turns smoothly.
 - If there is any damage or malfunction, replace the balancer unit.

Caution

- Due to the precision interior construction of the balancer unit, it cannot be disassembled.

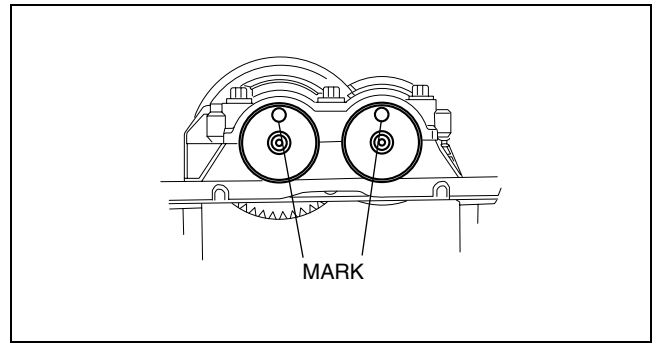
2. Install the **SST** as shown in the figure.
3. Turn the crankshaft clockwise the crankshaft is in the No.1 cylinder TDC position (until the balance weight is attached to the **SST**).
4. Install the adjustment shim to the seat face of the balancer unit.



B3E0110E110

MECHANICAL

5. With the balancer unit marks at the exact top center, assemble the unit to the cylinder block.

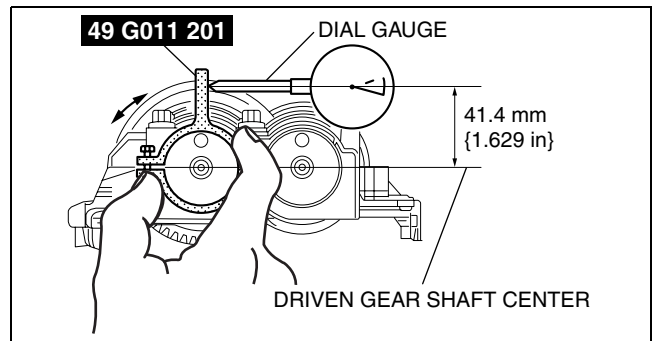


B3E0110E111

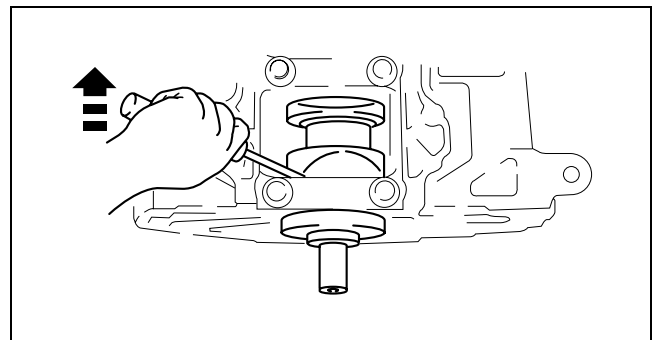
6. Set the **SST** as shown, then measure the gear backlash using a dial gauge.

Note

- For an accurate measurement of gear backlash, insert a screwdriver into the crankshaft No. 1 balance weight area and set both the rotation and the thrust direction with the screwdriver, using a prying action, as shown in the figure.
- If the backlash exceeds the specified range, remeasure the backlash and, using the adjustment shim selection table, select the proper shim, according to the following procedure.



B3E0110E112



B3E0110E113

Caution

- **When measuring the backlash, rotate the crankshaft one full rotation and verify that it is within the specified range at all of the following six positions: 10°, 30°, 100°, 190°, 210°, 280° ATDC.**

Value range

0.005—0.101 mm {0.00019—0.0039 in}

- (1) Using master adjustment shim (No.50), assemble the balancer unit to the cylinder block, then measure the backlash.
- (2) Select the proper adjustment shim according to the measured value.
- (3) Install the selected adjustment shim to the balancer unit, then assemble the balancer unit to the cylinder block.

MECHANICAL

Adjustment shim selection table

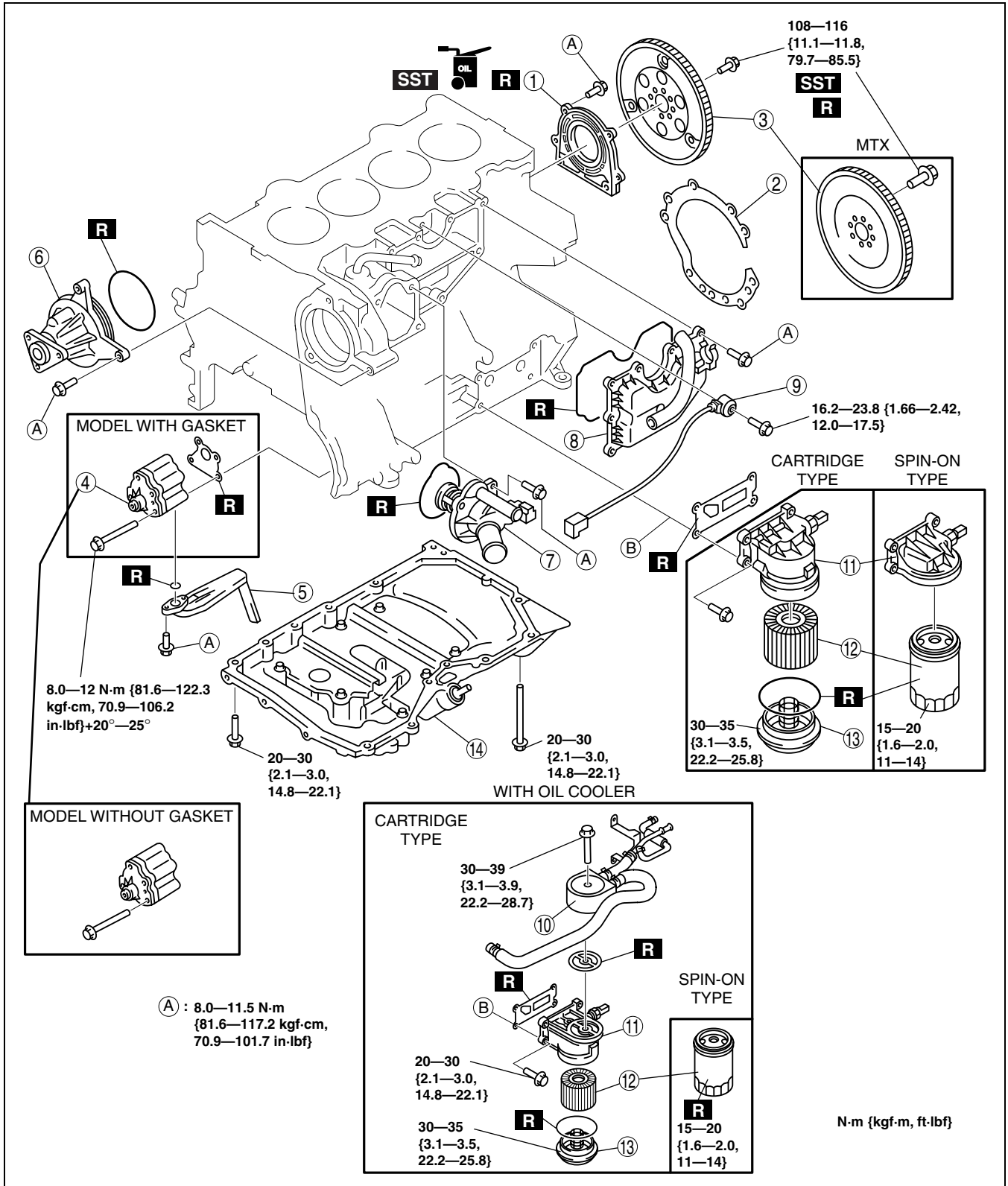
Backlash mm {in}	Selection shim (No.)	Shim thickness mm {in}	Backlash mm {in}	Selection shim (No.)	Shim thickness mm {in}
0.267—0.273 {0.01051— 0.01074}	15	1.15 {0.0452}	0.127—0.133 {0.00500— 0.00523}	35	1.35 {0.0531}
0.260—0.266 {0.01023— 0.01047}	16	1.16 {0.0456}	0.120—0.126 {0.00472— 0.00496}	36	1.36 {0.0535}
0.253—0.259 {0.00996— 0.01019}	17	1.17 {0.0460}	0.113—0.119 {0.00444— 0.00468}	37	1.37 {0.0539}
0.246—0.252 {0.00968— 0.00992}	18	1.18 {0.0464}	0.106—0.112 {0.00417— 0.00440}	38	1.38 {0.0543}
0.239—0.245 {0.00940— 0.00964}	19	1.19 {0.0468}	0.099—0.105 {0.00389— 0.00413}	39	1.39 {0.0547}
0.232—0.238 {0.00913— 0.00937}	20	1.20 {0.0472}	0.092—0.098 .087 {0.00362— 0.00385}	40	1.40 {0.0551}
0.225—0.231 {0.00885— 0.00909}	21	1.21 {0.0476}	0.085—0.091 {0.00334— 0.00358}	41	1.41 {0.0555}
0.218—0.224 {0.00858— 0.00881}	22	1.22 {0.0480}	0.078—0.084 {0.00307— 0.00330}	42	1.42 {0.0559}
0.211—0.217 {0.00830— 0.00854}	23	1.23 {0.0484}	0.071—0.077 {0.00279— 0.00303}	43	1.43 {0.0562}
0.204—0.210 {0.00803— 0.00826}	24	1.24 {0.0488}	0.064—0.070 {0.00251— 0.00275}	44	1.44 {0.0566}
0.197—0.203 {0.00775— 0.00799}	25	1.25 {0.492}	0.057—0.063 {0.00224— 0.00248}	45	1.45 {0.0570}
0.190—0.196 {0.00748— 0.00771}	26	1.26 {0.496}	0.050—0.056 {0.00196— 0.00220}	46	1.46 {0.0574}
0.183—0.189 {0.00720— 0.00744}	27	1.27 {0.499}	0.043—0.049 {0.00169— 0.00192}	47	1.47 {0.0578}
0.176—0.182 {0.00692— 0.00716}	28	1.28 {0.503}	0.036—0.042 {0.00141— 0.00165}	48	1.48 {0.0582}
0.169—0.175 {0.00665— 0.00688}	29	1.29 {0.507}	0.029—0.035 {0.00114— 0.00137}	49	1.49 {0.0586}
0.162—0.168 {0.00637— 0.00661}	30	1.30 {0.511}	0.022—0.028 {0.000866— 0.00110}	50 (master)	1.50 {0.0590}
0.155—0.161 {0.00610— 0.00633}	31	1.31 {0.515}	0.015—0.021 {0.00059— 0.000826}	51	1.51 {0.0594}
0.148—0.154 {0.00582— 0.00606}	32	1.32 {0.519}	0.008—0.014 {0.000314— 0.000551}	52	1.52 {0.0598}
0.141—0.147 {0.00555— 0.00578}	33	1.33 {0.523}	0.001—0.007 {0.00003— 0.000275}	53	1.53 {0.0602}
0.134—0.140 {0.00527— 0.00551}	34	1.34 {0.527}	0.000—0.000 {0.000—0.000}	54	1.54 {0.0606}

MECHANICAL

CYLINDER BLOCK (II) ASSEMBLY

B3E011002000221

1. Assemble in the order indicated in the table.



B3E0110W126

1	Rear oil seal (See 01-10-34 Rear Oil Seal Assembly Note)
2	End plate (MTX)
3	Flywheel (MTX), Drive plate (ATX) (See 01-10-34 Drive Plate (ATX), Flywheel (MTX) Assembly Note)

4	Oil pump
5	Oil strainer
6	Water pump
7	Thermostat
8	Oil separator

MECHANICAL

9	Knock sensor
10	Oil cooler
11	Oil filter adapter
12	Oil filter
13	Oil filter cover (cartridge type)
14	Oil pan (See 01-10-35 Oil pan Assembly Note)

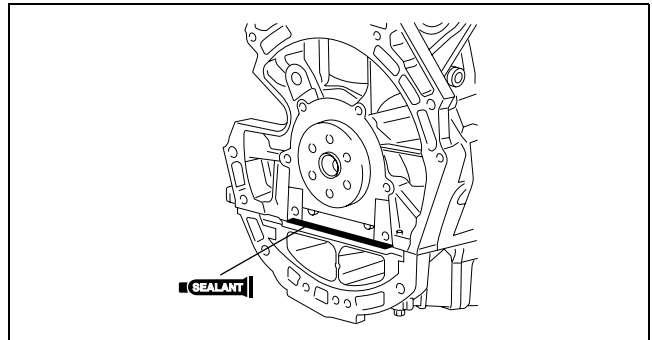
Rear Oil Seal Assembly Note

1. Apply silicone sealant to the mating faces as shown in the figure.

Thickness

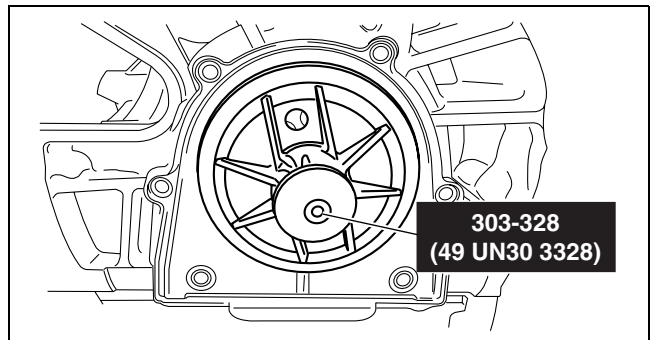
4.0—6.0 mm {0.16—0.23 in}

2. Apply clean engine oil to the new oil seal lip.



B3E0110E114

3. Install the rear oil seal using the **SST** as shown in the figure.
4. Tighten the rear oil seal bolts in the order as shown in the figure. (Except TRIBUTE (L.H.D.) Face-lifted model.)

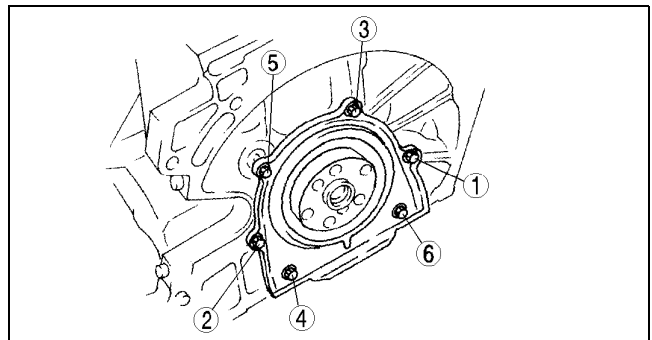


CUE110BW2005

Tightening torque

8.0—11.5 N·m

{81.6—117.2 kgf·cm, 70.9—101.7 in·lbf}



AME2224E002

Drive Plate (ATX), Flywheel (MTX) Assembly Note

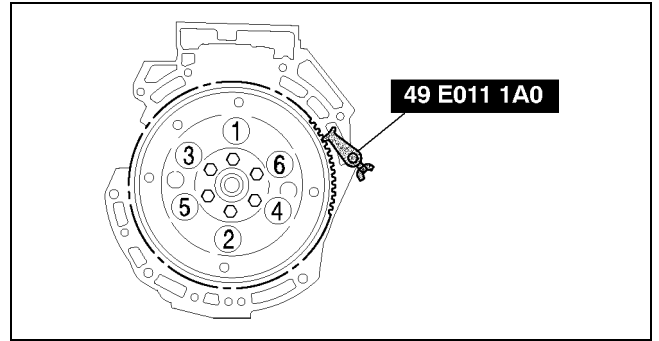
1. Hold the crankshaft using the **SST**.

MECHANICAL

- Tighten the bolts in the 3 steps in the figure.

Tightening torque

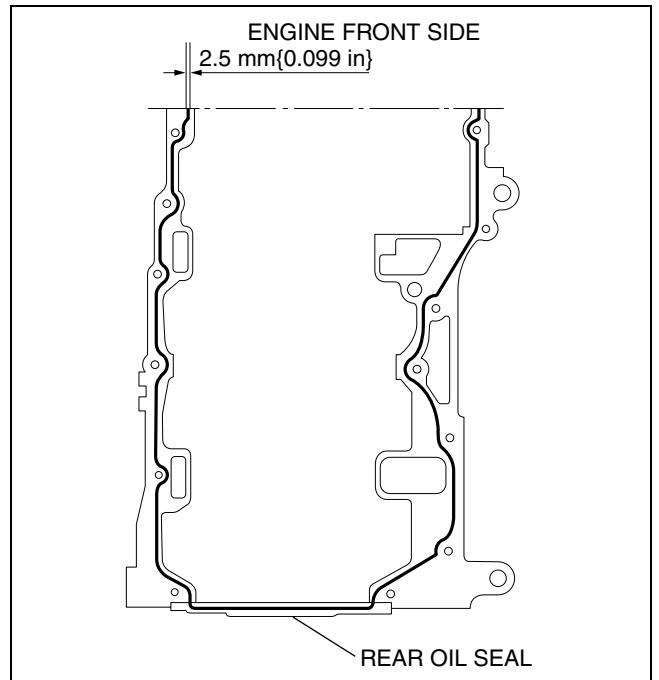
- (1) 46—54 N·m
 {4.70—5.50 kgf·m, 34.0—39.8 ft·lbf}
- (2) 76—84 N·m
 {7.75—8.56 kgf·m, 56.1—61.9 ft·lbf}
- (3) 108—116 N·m
 {11.1—11.8 kgf·m, 79.7—85.5 ft·lbf}



AME2224E102

Oil pan Assembly Note

- Apply a continuous bead of silicone sealant to the oil pan as indicated in the figure.

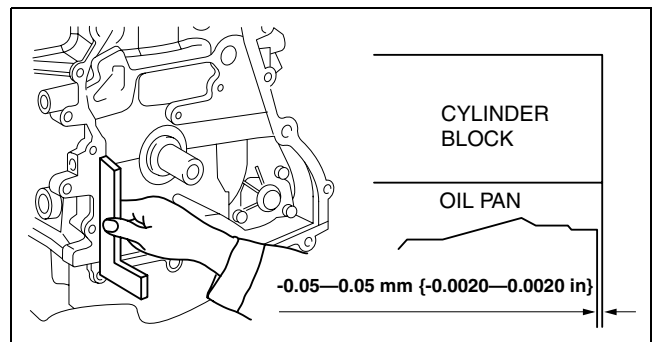


B3E0110E121

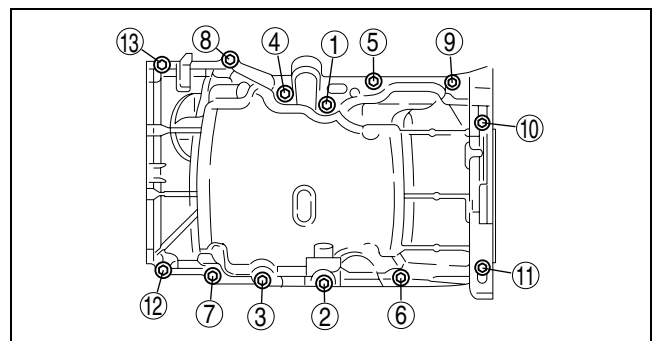
- Use a square ruler to unite the oil pan and the cylinder block junction side on the engine front cover side.
- Tighten the rear oil pan bolts in the order as shown in the figure.

Tightening torque

- 20—30 N·m
 {2.1—3.0 kgf·m, 15.2—21.6 in·lbf}



B3E0110E120



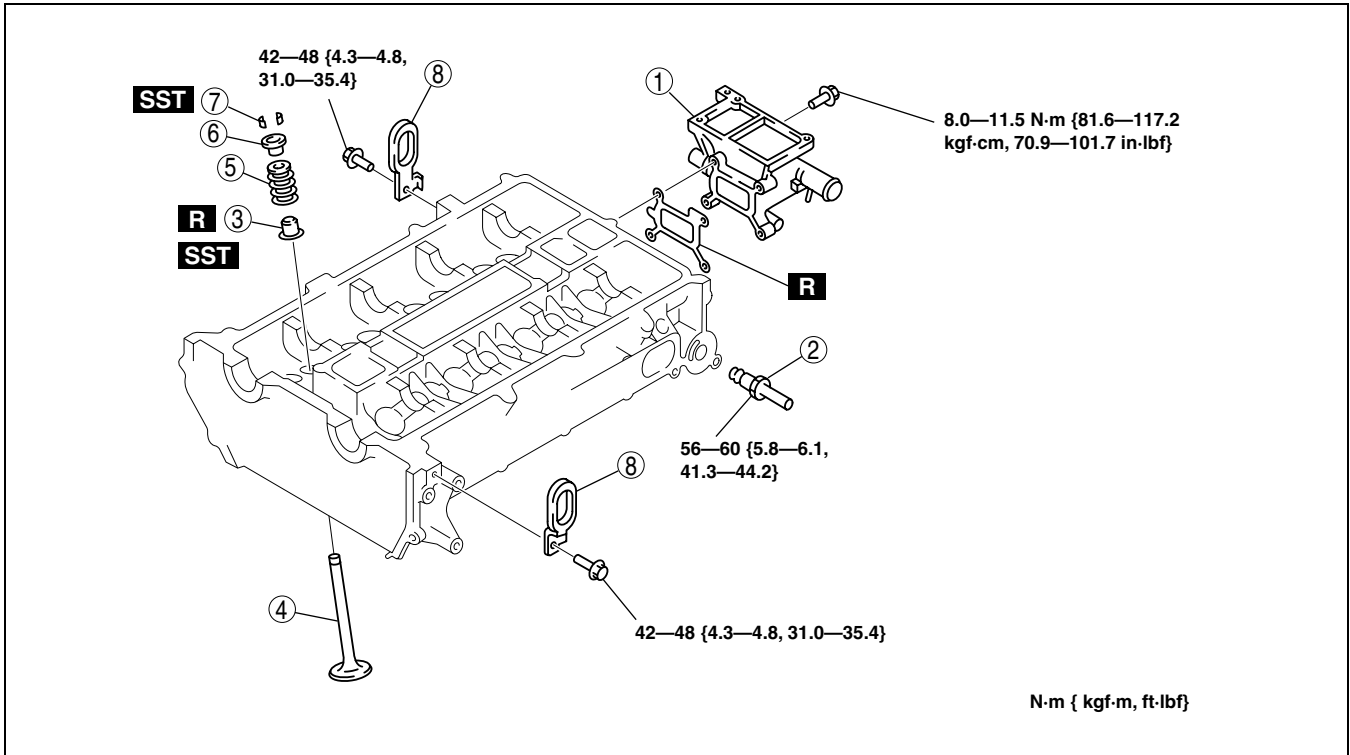
B3E0110E122

MECHANICAL

CYLINDER HEAD (I) ASSEMBLY

B3E011002000222

1. Assemble in the order indicated in the table.



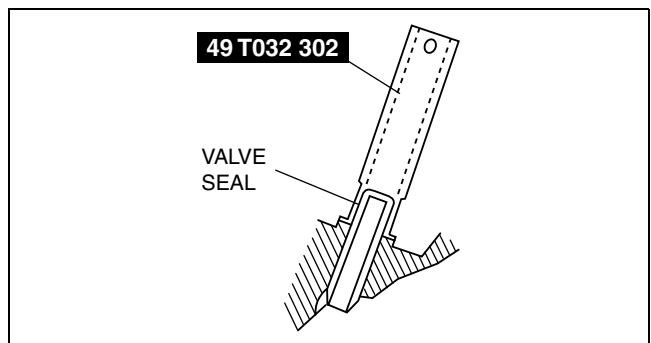
B3E0110E130

1	Water outlet case
2	EGR pipe
3	Valve seal (See 01-10-36 Valve Seal Assembly Note)
4	Valve

5	Valve spring
6	Upper valve spring seat
7	Valve keeper (See 01-10-36 Valve Keeper Assembly Note)
8	Engine hanger

Valve Seal Assembly Note

1. Press the valve seal onto the valve guide by hand.
2. Lightly tap the **SST** using a plastic hammer.



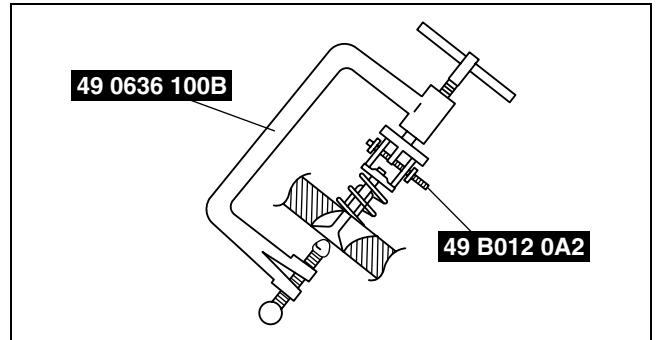
B3E0110E123

Valve Keeper Assembly Note

1. Install the valve keeper using the **SSTs**.

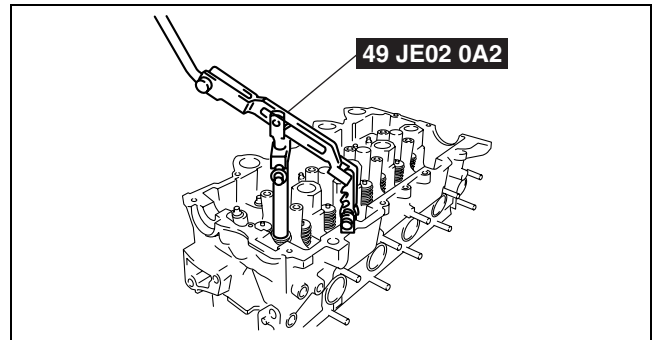
MECHANICAL

When using the SSTs (49 0636 100B, 49 B012 0A2)



B3E0110E124

When using the SST (49 JE02 0A2) (Europe only)



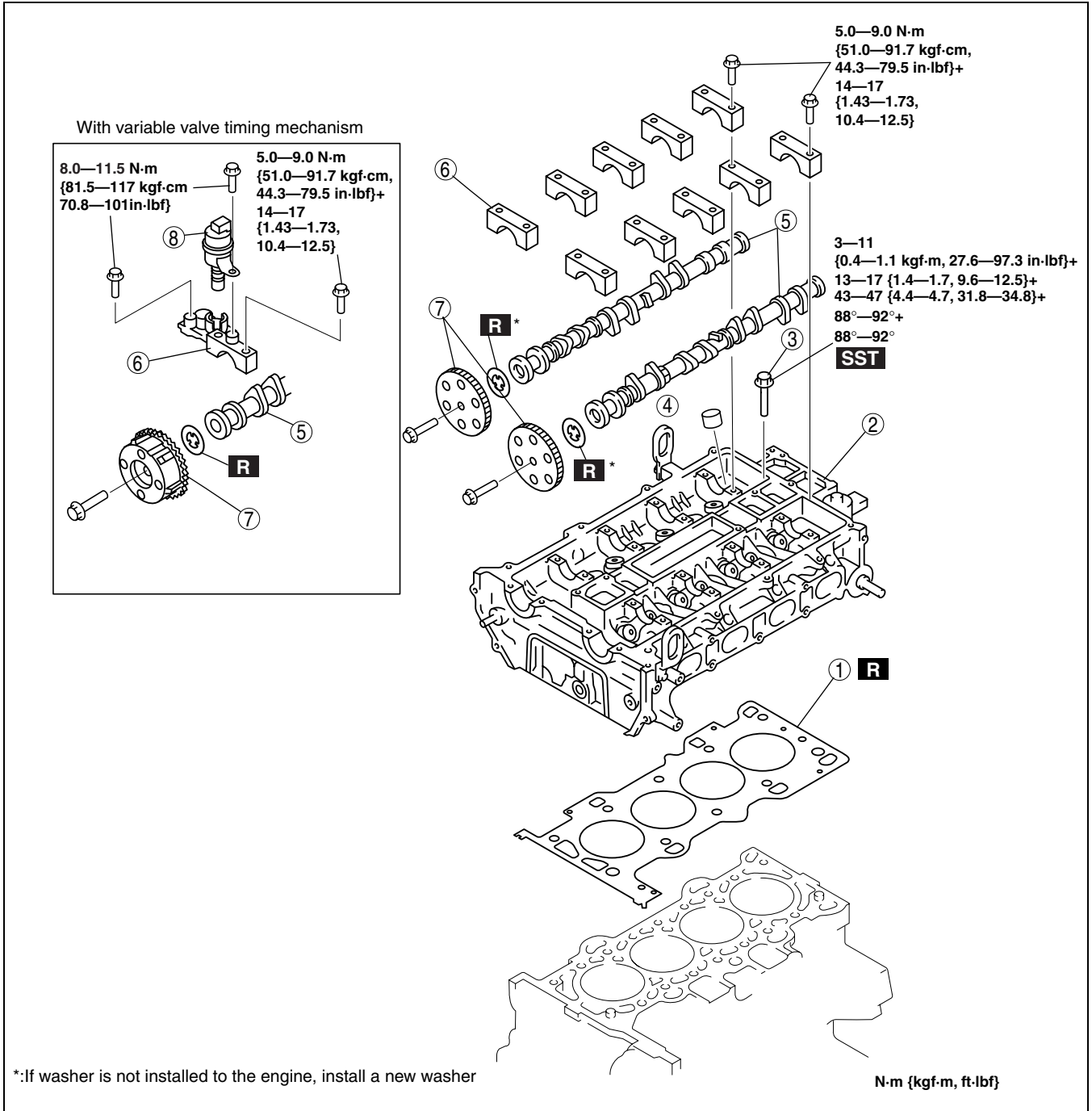
CUE110ZER01

CYLINDER HEAD (II) ASSEMBLY

1. Assemble in the order indicated in the table.

B3E011002000211

MECHANICAL



D6E110ZE1011

1	Cylinder head gasket
2	Cylinder head
3	Cylinder head bolt (See 01-10-39 Cylinder Head Bolt Assembly Note)
4	Tappet
5	Camshaft (See 01-10-39 Camshaft Assembly Note)
6	Camshaft cap
7	Camshaft sprocket, variable valve timing actuator (With variable valve timing mechanism) (See 01-10-39 Camshaft Sprocket, Variable Valve Timing Actuator (With variable valve timing mechanism) Assembly Note)
8	Oil control valve (OCV) (With variable valve timing mechanism)

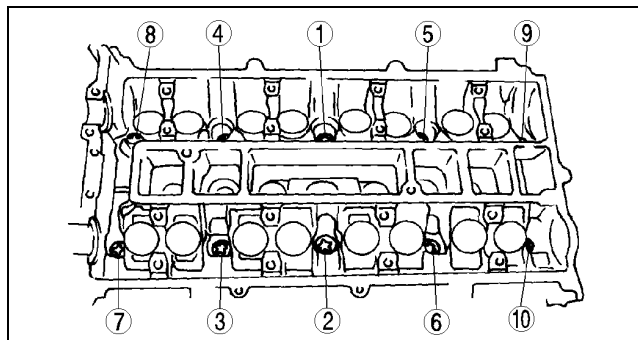
MECHANICAL

Cylinder Head Bolt Assembly Note

1. Tighten the cylinder head bolts in the order indicated in the figure in 5 steps using the **SST (49 D032 316)**.

Tightening torque

- (1) 3—11 N·m
{0.4—1.1 kgf·m, 27.6—97.3 in·lbf}
- (2) 13—17 N·m
{1.4—1.7 kgf·m, 9.59—12.5 ft·lbf}
- (3) 43—47 N·m
{4.4—4.7 kgf·m, 31.8—34.6 ft·lbf}
- (4) 88°—92°
- (5) 88°—92°



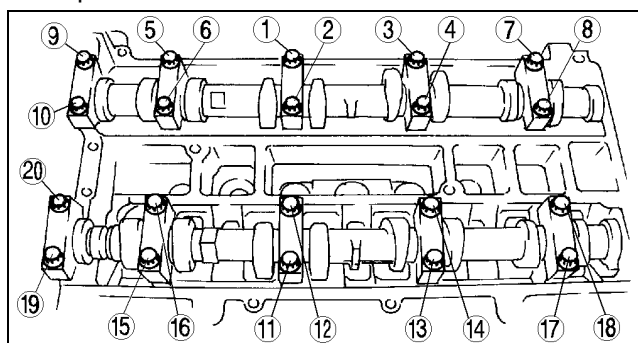
AME2224E047

Camshaft Assembly Note

1. Set the cam position of No.1 cylinder at the top dead center (TDC) and install the camshaft.
2. Temporarily tighten the camshaft bearing caps evenly in 2—3 passes.
3. Tighten the camshaft cap bolt in the order shown two steps.

Tightening torque

- (1) 5.0—9.0 N·m
{51.0—91.7 kgf·cm, 44.3—79.6 in·lbf}
- (2) 14.0—17.0 N·m
{1.5—1.7 kgf·m, 10.4—12.5 ft·lbf}



AME2224E048

Camshaft Sprocket, Variable Valve Timing Actuator (With variable valve timing mechanism) Assembly Note

1. Temporarily tighten the camshaft sprocket or variable valve timing actuator (With variable valve timing mechanism) installation bolts by hand until the timing chain is installed.
2. Fully tighten the camshaft sprocket or variable valve timing actuator (With variable valve timing mechanism) installation bolts after timing chain installation.

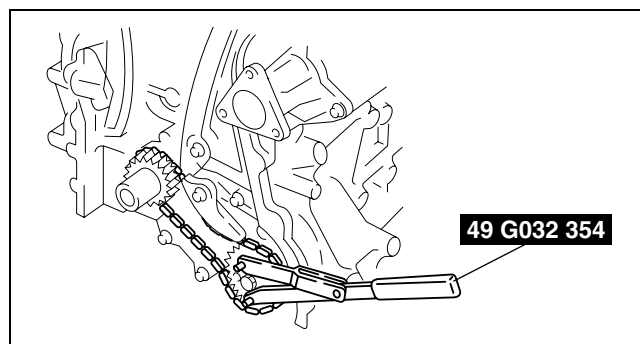
01

MECHANICAL

12	Front oil seal (See 01-10-42 Front Oil Seal Assembly Note.)
13	Engine front cover (See 01-10-43 Engine Front Cover Assembly Note.)
14	Drive belt idler pulley (Without stretch-type A/C drive belt)
15	Water pump pulley
16	Crankshaft pulley
17	Crankshaft pulley lock bolt (See 01-10-44 Crankshaft Pulley Lock Bolt Assembly Note.)
18	Cylinder head cover (See 01-10-45 Cylinder Head Cover Assembly Note)
19	Spark plug
20	Oil level gauge (If equipped)

Oil Pump Sprocket Assembly Note

1. Hold the oil pump sprocket using the **SST**.

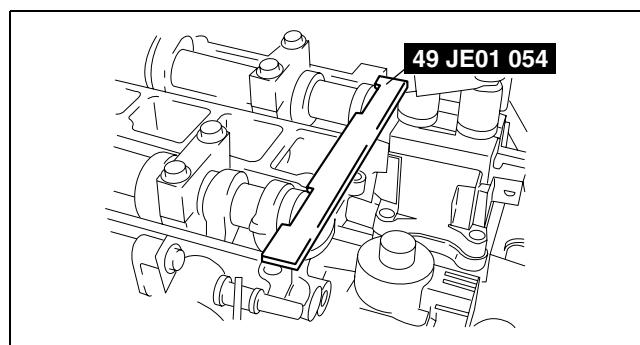


B3E0110E125

Timing Chain Assembly Note

1. Install the **SST** to the camshaft, then align the No. 1 camshaft position with the TDC.

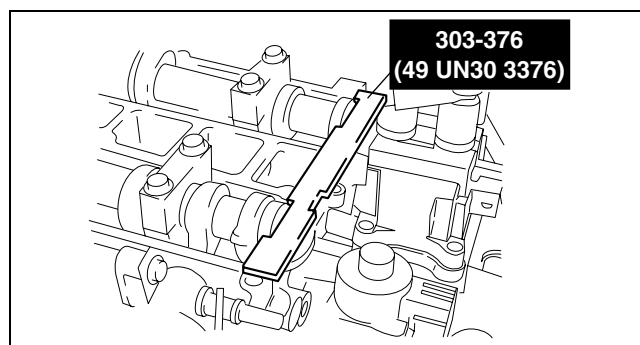
Europe



B3E0110E099

Except Europe

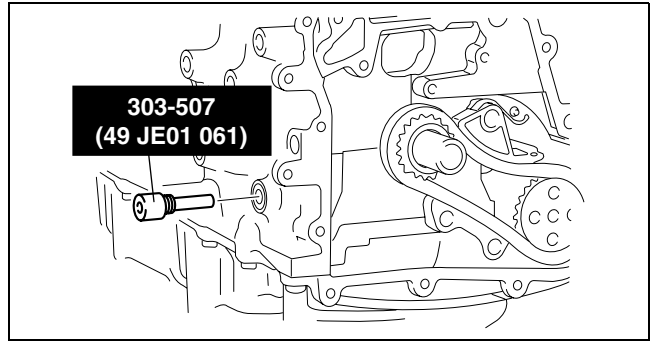
2. Remove the cylinder block lower blind plug.



B3E0110E100

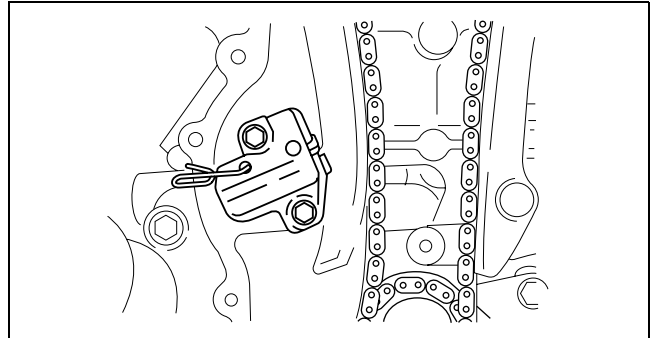
MECHANICAL

3. Install the **SST** as shown in the figure.
4. Turn the crankshaft clockwise so that the crankshaft is in the No.1 cylinder TDC position.
5. Install the timing chain.



B3E0110E110

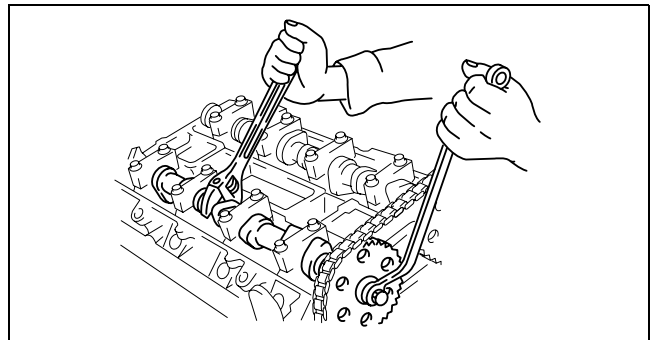
6. Install the chain tensioner and remove the retaining wire.



B3E0110E126

Camshaft Sprocket, Variable Valve Timing Actuator (With variable valve timing mechanism) Assembly Note

1. Hold the camshaft using a suitable wrench on the cast hexagon as shown in the figure.
2. Tighten the camshaft sprocket lock bolt.



B3E0110E095

N·m {kgf·m, ft·lbf}			
Engine type	Camshaft sprocket	Bolt type	Tightening torque
L8 LF L3	IN side	B	89—95 {9.1—9.6, 65.7—70.0}
		C	69—75 {7.1—7.6, 50.9—55.3}
	EX side	A, C	69—75 {7.1—7.6, 50.9—55.3}
L3*1 LF*1	IN side	A	Can not use
		B, C	69—75 {7.1—7.6, 50.9—55.3}
	EX side	A, C	69—75 {7.1—7.6, 50.9—55.3}

TYPE A : Bolt (Gold), Washer (Gold)

TYPE B : Washer based bolt (Black)

TYPE C : Bolt (Black), Washer (Gray)

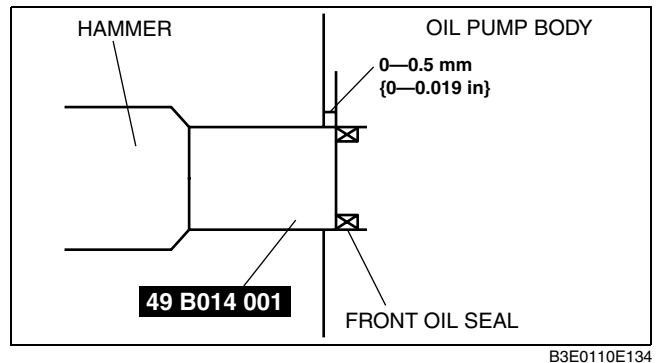
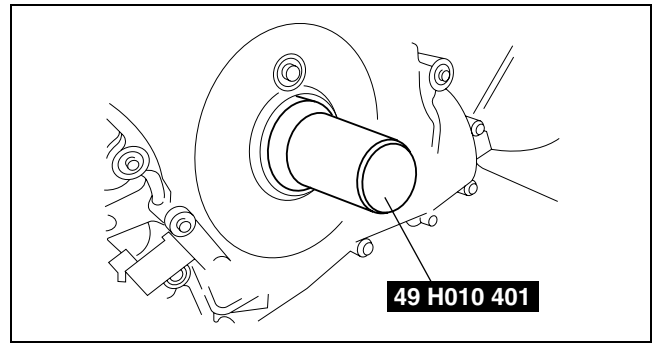
*1 : With variable valve timing mechanism

Front Oil Seal Assembly Note

1. Apply clean engine oil to the oil seal.
2. Push the oil seal slightly in by hand.

MECHANICAL

3. Compress the oil seal using the **SST** and a hammer.



Engine Front Cover Assembly Note

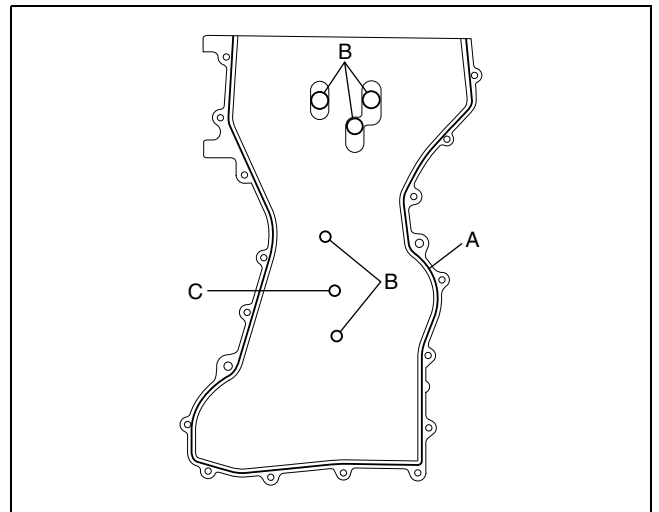
1. Apply silicone sealant to the engine front cover as shown in the figure.

Caution

- Install the cylinder head cover within 10 min of applying the silicone sealant.
- Silicone sealant is not need in area C as indicated below due to an existing. (With variable valve timing mechanism)

Thickness

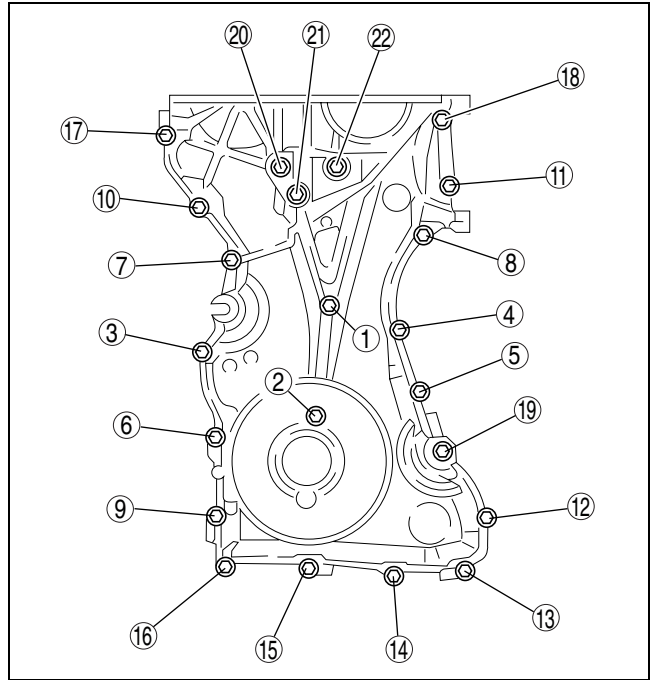
- A: 2.0—3.0 mm {0.079—0.118 in}
- B: 1.5—2.5 mm {0.059—0.098 in}



MECHANICAL

2. Install the cylinder head cover bolts in the order as shown in the figure.

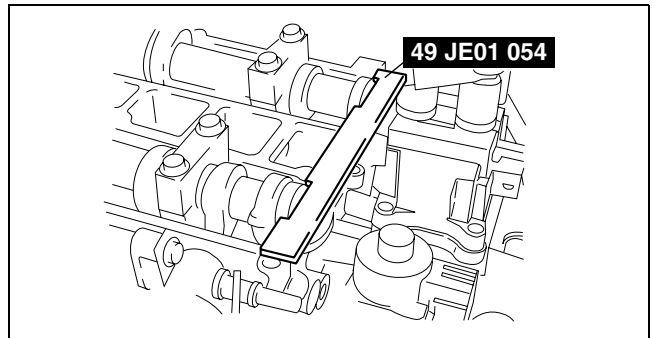
Bolt No.	Tightening torque N·m {kgf·m, ft·lbf}
1—18	8.0—11.5 N·m {81.6—117.2 kgf·cm, 70.9—101.7 in·lbf}
19—22	40—55 {4.1—5.6, 29.7—40.5}



B3E0110E062

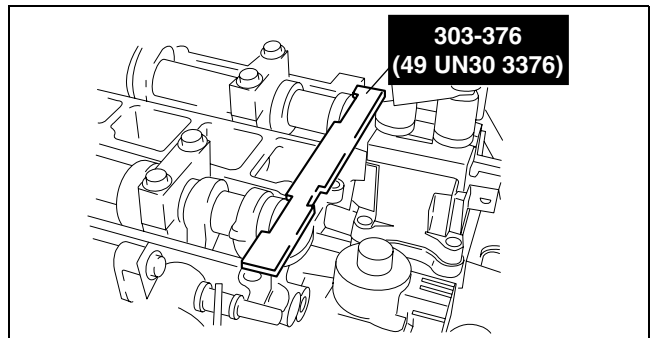
Crankshaft Pulley Lock Bolt Assembly Note

1. Install the **SST** to the camshaft as shown in the figure.
Europe



B3E0110E099

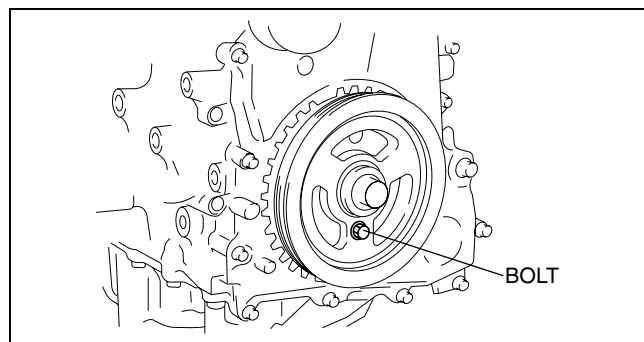
Except Europe



B3E0110E100

MECHANICAL

2. Install the M6 × 1.0 bolt in by hand.
3. Turn the crankshaft clockwise so that the crankshaft is in the No.1 cylinder TDC position.

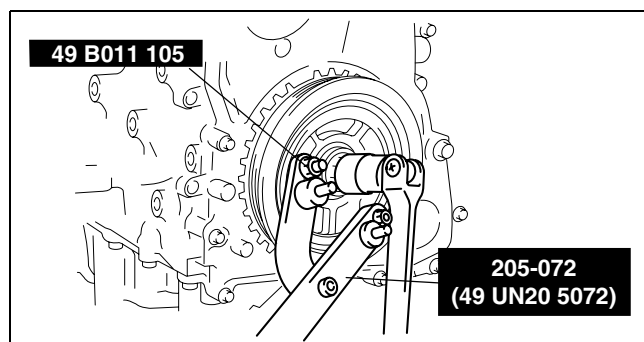


4. Hold the crankshaft pulley using the **SST**.
5. Tighten the crankshaft pulley lock bolt in the order shown following two steps using the **SST (49 D032 316)**.

Tightening torque

- (1) 96—104 N·m
{9.8—10.6 kgf·m, 70.9—76.7 ft·lbf}
- (2) 87°—93°

6. Remove the M6 × 1.0 bolt.
7. Remove the **SST** from the camshaft.
8. Remove the **SST** from the block lower blind plug.
9. Rotate the crankshaft clockwise two turns until the TDC position.
 - If not aligned, loosen the crankshaft pulley lock bolt and repeat from Step 1.
10. Install the cylinder block lower blind plug.



Tightening torque

- 20 N·m {2.0 kgf·m, 14.8 ft·lbf}

Cylinder Head Cover Assembly Note

1. Apply silicone sealant to the mating faces as shown in the figure.

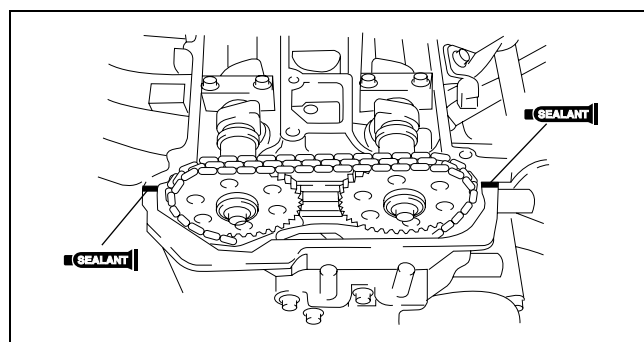
Caution

- Install the cylinder head cover within 10 min of applying the silicone sealant.

Dot diameter

- 4.0—6.0 mm {0.16—0.23 in}

2. Install the cylinder head cover with a new gasket.



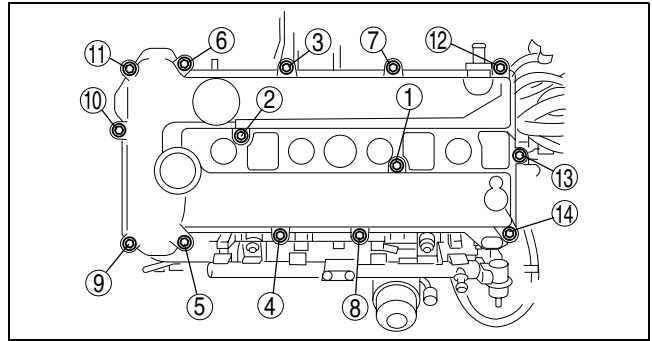
MECHANICAL

3. Tighten the bolts in the order shown in the figure.

Tightening torque

8.0 —12 N·m

{81.6—122.3 kgf·cm, 70.9—106.2 in·lbf}



B3E0110W050

TECHNICAL DATA

01-50 TECHNICAL DATA

ENGINE TECHNICAL DATA 01-50-1

ENGINE TECHNICAL DATA

B3E015002000201

Except TRIBUTE (L.H.D.) Face-lifted model

Item			Engine			
			L8	LF	L3	
Cylinder head						
Cylinder head gasket contact surfaces distortion	(mm {in})	Maximum	0.10 {0.004}			
Manifold contact surfaces distortion	(mm {in})	Maximum	0.10 {0.004}			
		Maximum grinding	0.15 {0.006}			
Valve clearance [Engine cold]	(mm {in})	IN	0.22—0.28 {0.0087—0.0110}			
		EX	0.27—0.33 {0.0106—0.0130}			
Valve and valve guide						
Valve stem diameter	(mm {in})	Standard	IN	5.470—5.485 {0.2154—0.2159}		
			EX	5.465—5.480 {0.2152—0.2157}		
		Minimum	IN	5.470 {0.2154}		
			EX	5.465 {0.2152}		
Valve stem to guide clearance	(mm {in})	Standard	IN	0.024—0.069 {0.0009—0.0027}		
			EX	0.029—0.074 {0.0012—0.0029}		
		Maximum	IN	0.10 {0.004}		
			EX	0.10 {0.004}		
Valve length	(mm {in})	Standard	IN	102.99—103.79 {4.055—4.086}		
			EX	104.25—105.05 {4.105—4.135}		
		Minimum	IN	102.99 {4.055}		
			EX	104.25 {4.104}		
Valve guide inner diameter	(mm {in})	Standard	IN	5.509—5.539 {0.2169—0.2180}		
			EX	5.509—5.539 {0.2169—0.2180}		
Valve guide protrusion height	(mm {in})	Standard	IN	12.2—12.8 {0.481—0.503}		
			EX	12.2—12.8 {0.481—0.503}		
Valve head margin thickness	(mm {in})	Minimum	IN	1.62 {0.0637}		
			EX	1.82 {0.0716}		
Valve seat						
Valve seat contact width	(mm {in})	Standard	IN	1.2—1.6 {0.048—0.062}		
			EX	1.2—1.6 {0.048—0.062}		
Valve seat angle	(°)		IN	45		
			EX	45		
Valve seat sinking (Valve protrusion height)	(mm {in})	Standard	IN	40.64—42.24 {1.600—1.662}		
			EX	40.50—42.10 {1.595—1.657}		
Valve spring						
Out-of-square	(mm {in})	Maximum	1.95 {0.0767}			
Pressing force	(N {kgf, lbf}) [mm {in}]	Standard height H	390 {39.76, 87.67} [28.68 {1.129}]			
Camshaft						
Camshaft runout	(mm {in})	Maximum	0.03 {0.0012}			
Cam lobe height	(mm {in})	Standard	IN	40.79 {1.606}	42.12 {1.659}	42.44 {1.671}
			EX	41.08 {1.618}	41.08 {1.618}	41.18 {1.622}
		Minimum	IN	40.67 {1.601}	42.01 {1.653}	42.33 {1.666}
			EX	40.96 {1.612}	40.96 {1.612}	41.06 {1.616}
Journal diameter	(mm {in})	Standard	24.96—24.98 {0.9827—0.9834}			
		Minimum	24.95 {0.982}			
Journal oil clearance	(mm {in})	Standard	0.04—0.08 {0.002—0.003}			
		Maximum	0.09 {0.0035}			

01

TECHNICAL DATA

Item		Engine		
		L8	LF	L3
End play	(mm {in})	Standard	0.09—0.24 {0.0035—0.0099}	
		Maximum	0.25 {0.009}	
Tappet				
Tappet bore diameter	(mm {in})	Standard	31.000—31.030 {1.2205—1.2216}	
Tappet diameter	(mm {in})	Standard	30.970—30.980 {1.2193—1.2196}	
Tappet-to-Tappet bore oil clearance	(mm {in})	Standard	0.02—0.06 {0.0008—0.0023}	
		Maximum	0.15 {0.006}	
Cylinder block				
Cylinder head gasket contact surfaces distortion	(mm {in})	Maximum	0.10 {0.004}	
Cylinder bore diameter [Measure the cylinder bore at 42 mm {1.65 in} below the top surface]	(mm {in})	Standard	83.000—83.030 {3.2677—3.2689}	87.500—87.530 {3.4449—3.4460}
Minimum / maximum bore diameter Limit	(mm {in})		82.940—83.090 {3.2653—3.2712}	87.440—87.590 {3.4425—3.4484}
Piston				
Piston diameter	(mm {in})	Standard	82.965—82.995 {3.2664—3.2675}	87.465—87.495 {3.4435—3.4446}
Piston-to-cylinder clearance	(mm {in})	Standard	0.022—0.047 {0.0009—0.0018}	
		Maximum	0.11 {0.0043}	
Piston ring				
Piston ring-to-ring groove clearance	(mm {in})	Standard	Top	0.04—0.08 {0.0016—0.0031}
			Second	0.03—0.07 {0.0012—0.0027}
			Oil (rail)	0.06—0.15 {0.0024—0.0059}
	Maximum	Top	0.17 {0.0067}	
		Second	0.15 {0.0059}	
		Oil (rail)	0.15 {0.0059}	
End gap (measured in cylinder)	(mm {in})	Standard	Top	0.16—0.26 {0.0063—0.010}
			Second	0.33—0.48 {0.0130—0.0189}
			Oil (rail)	0.20—0.70 {0.0079—0.0275}
	Maximum	Top	1.0 {0.0393}	
		Second	1.0 {0.0393}	
		Oil (rail)	1.0 {0.0393}	
Connecting rod and connecting rod bearing				
Connecting rod side clearance	(mm {in})	Standard	0.14—0.36 {0.0056—0.0141}	
		Maximum	0.435 {0.0172}	
Connecting rod bearing size	(mm {in})	Standard	1.498—1.504 {0.0589—0.0592}	1.496—1.502 {0.0589—0.0591}
		0.25 {0.01} Oversize	1.623—1.629 {0.0639—0.0641}	1.621—1.627 {0.0639—0.0641}
		0.50 {0.02} Oversize	1.748—1.754 {0.0688—0.0690}	1.746—1.752 {0.0688—0.0690}
Connecting rod bearing oil clearance	(mm {in})	Standard	0.026—0.052 {0.0011—0.0020}	
		Maximum	0.10 {0.0039}	
Crankshaft				
Crankshaft runout	(mm {in})	Maximum	0.05 {0.0019}	
Main journal diameter	(mm {in})	Standard	51.980—52.000 {2.0464—2.0472}	
		0.25 {0.01} undersize	51.730—51.750 {2.0366—2.0373}	
Main journal oil clearance	(mm {in})	Standard	0.019—0.035 {0.0007—0.0013}	
		Maximum	0.10 {0.0039}	
Main journal out of round	(mm {in})	Maximum	0.05 {0.0019}	

TECHNICAL DATA

Item		Engine		
		L8	LF	L3
Main bearing size	(mm {in})	Standard	2.506—2.509 {0.0987—0.0988}	
		0.25 {0.01} Oversize	2.628—2.634 {0.1034—0.1037}	
		0.50 {0.02} Oversize	2.753—2.759 {0.1084—0.1086}	
Crank pin journal diameter	(mm {in})	Standard	46.980—47.000 {1.8497—1.8503}	49.980—50.000 {1.9677—1.9685}
		0.25 {0.01} undersize	46.730—46.750 {1.8398—1.8405}	49.730—49.750 {1.9579—1.9586}
Crank pin out of round	(mm {in})	Maximum	0.05 {0.022}	
Crankshaft end play	(mm {in})	Standard	0.22—0.45 {0.0087—0.0177}	
		Maximum	0.55 {0.0216}	
Front oil seal				
Pushing distance of the front oil seal [from the edge of the engine front cover]		(mm {in})	0—0.5 {0—0.019}	
Bolt				
Cylinder head bolt length		Standard	145.2—145.8 {5.72—5.74}	
		Maximum	146.5 {5.77}	
Connecting rod bolt length		Standard	44.7—45.3 {1.75—1.78}	
		Maximum	46.0 {1.81}	
Main bearing cap bolt length		Standard	110.0—110.6 {4.33—4.35}	
		Maximum	111.3 {4.38}	
Balance shaft				
Gear backlash	(mm {in})	Maximum	—	0.005-0.101 {0.00019—0.0039}

Item		Engine		
		LF (With variable valve timing mechanism) L3 (With variable valve timing mechanism)		
Cylinder head				
Cylinder head gasket contact surfaces distortion	(mm {in})	Maximum	0.10 {0.004}	
Manifold contact surfaces distortion	(mm {in})	Maximum	0.10 {0.004}	
		Maximum grinding	0.15 {0.006}	
Valve clearance [Engine cold]	(mm {in})	IN	0.22—0.28 {0.0087—0.0110}	
		EX	0.27—0.33 {0.0106—0.0130}	
Valve and valve guide				
Valve stem diameter	(mm {in})	Standard	IN	5.470—5.485 {0.2154—0.2159}
			EX	5.465—5.480 {0.2152—0.2157}
		Minimum	IN	5.470 {0.2154}
			EX	5.465 {0.2152}
Valve stem to guide clearance	(mm {in})	Standard	IN	0.024—0.069 {0.0009—0.0027}
			EX	0.029—0.074 {0.0012—0.0029}
		Maximum	IN	0.10 {0.004}
			EX	0.10 {0.004}
Valve length	(mm {in})	Standard	IN	102.99—103.79 {4.055—4.086}
			EX	104.25—105.05 {4.105—4.135}
		Minimum	IN	102.99 {4.055}
			EX	104.25 {4.104}
Valve guide inner diameter	(mm {in})	Standard	IN	5.509—5.539 {0.2169—0.2180}
			EX	5.509—5.539 {0.2169—0.2180}
Valve guide protrusion height	(mm {in})	Standard	IN	12.2—12.8 {0.481—0.503}
			EX	12.2—12.8 {0.481—0.503}
Valve head margin thickness	(mm {in})	Minimum	IN	1.62 {0.0637}
			EX	1.82 {0.0716}
Valve seat				

01

TECHNICAL DATA

Item			Engine	
			LF (With variable valve timing mechanism)	L3 (With variable valve timing mechanism)
Valve seat contact width	(mm {in})	Standard	IN	1.2—1.6 {0.048—0.062}
			EX	1.2—1.6 {0.048—0.062}
Valve seat angle		(°)	IN	45
			EX	45
Valve seat sinking (Valve protrusion height)	(mm {in})	Standard	IN	40.64—42.24 {1.600—1.662}
			EX	40.50—42.10 {1.595—1.657}
Valve spring				
Out-of-square	(mm {in})	Maximum		1.95 {0.0767}
Pressing force	(N {kgf, lbf}) [mm {in}]	Standard height H		390 {39.76, 87.67} [28.68 {1.129}]
OCV (Oil control valve)				
Coil resistance [20° C {68°F}]	(ohm)	Standard		6.9—7.9
Camshaft				
Camshaft runout	(mm {in})	Maximum		0.03 {0.0012}
Cam lobe height	(mm {in})	Standard	IN	42.44 {1.671}
			EX	41.18 {1.622}
		Minimum	IN	42.33 {1.666}
			EX	41.06 {1.616}
Journal diameter	(mm {in})	Standard		24.96—24.98 {0.9827—0.9834}
		Minimum		24.95 {0.982}
Journal oil clearance	(mm {in})	Standard		0.04—0.08 {0.002—0.003}
		Maximum		0.09 {0.0035}
End play	(mm {in})	Standard		0.09—0.24 {0.0035—0.0099}
		Maximum		0.25 {0.009}
Tappet				
Tappet bore diameter	(mm {in})	Standard		31.000—31.030 {1.2205—1.2216}
Tappet diameter	(mm {in})	Standard		30.970—30.980 {1.2193—1.2196}
Tappet-to-Tappet bore oil clearance	(mm {in})	Standard		0.02—0.06 {0.0008—0.0023}
		Maximum		0.15 {0.006}
Cylinder block				
Cylinder head gasket contact surfaces distortion	(mm {in})	Maximum		0.10 {0.004}
Cylinder bore diameter [Measure the cylinder bore at 42 mm {1.65 in} below the top surface]	(mm {in})	Standard		87.500—87.530 {3.4449—3.4460}
Minimum / maximum bore diameter Limit		(mm {in})		87.440—87.590 {3.4425—3.4484}
Piston				
Piston diameter	(mm {in})	Standard		87.465—87.495 {3.4435—3.4446}
Piston-to-cylinder clearance	(mm {in})	Standard		0.022—0.047 {0.0009—0.0018}
		Maximum		0.11 {0.0043}
Piston ring				
Piston ring-to-ring groove clearance	(mm {in})	Standard	Top	0.04—0.08 {0.0016—0.0031}
			Second	0.03—0.07 {0.0012—0.0027}
			Oil (rail)	0.06—0.15 {0.0024—0.0059}
		Maximum	Top	0.17 {0.0067}
			Second	0.15 {0.0059}
			Oil (rail)	0.15 {0.0059}

TECHNICAL DATA

Item			Engine	
			LF (With variable valve timing mechanism) L3 (With variable valve timing mechanism)	
End gap (measured in cylinder)	Standard	Top	0.16—0.26 {0.0063—0.010}	
		Second	0.33—0.48 {0.0130—0.0189}	
		Oil (rail)	0.20—0.70 {0.0079—0.0275}	
	Maximum	Top	1.0 {0.0393}	
		Second	1.0 {0.0393}	
Oil (rail)		1.0 {0.0393}		
Connecting rod and connecting rod bearing				
Connecting rod side clearance	(mm {in})	Standard	0.14—0.36 {0.0056—0.0141}	
		Maximum	0.435 {0.0172}	
Connecting rod bearing size	(mm {in})	Standard	1.496—1.502 {0.0589—0.0591}	
		0.25 Oversize	1.621—1.627 {0.0639—0.0641}	
		0.50 Oversize	1.746—1.752 {0.0688—0.0690}	
Connecting rod bearing oil clearance	(mm {in})	Standard	0.026—0.052 {0.0011—0.0020}	
		Maximum	0.10 {0.0039}	
Crankshaft				
Crankshaft runout	(mm {in})	Maximum	0.05 {0.0019}	
Main journal diameter	(mm {in})	Standard	51.980—52.000 {2.0464—2.0472}	
		0.25 {0.01} undersize	51.730—51.750 {2.0366—2.0373}	
Main journal oil clearance	(mm {in})	Standard	0.019—0.035 {0.0007—0.0013}	
		Maximum	0.10 {0.0039}	
Main journal out of round	(mm {in})	Maximum	0.05 {0.0019}	
Main bearing size	(mm {in})	Standard	2.506—2.509 {0.0987—0.0988}	
		0.25 {0.01} Oversize	2.628—2.634 {0.1034—0.1037}	
		0.50 {0.02} Oversize	2.753—2.759 {0.1084—0.1086}	
Crank pin journal diameter	(mm {in})	Standard	49.980—50.000 {1.9677—1.9685}	
		0.25 {0.01} undersize	49.730—49.750 {1.9579—1.9586}	
Crank pin out of round	(mm {in})	Maximum	0.05 {0.0022}	
Crankshaft end play	(mm {in})	Standard	0.22—0.45 {0.0087—0.0177}	
		Maximum	0.55 {0.0216}	
Front oil seal				
Pushing distance of the front oil seal [from the edge of the engine front cover]		(mm {in})	0—0.5 {0—0.019}	
Bolt				
Cylinder head bolt length		Standard	145.2—145.8 {5.72—5.74}	
		Maximum	146.5 {5.77}	
Connecting rod bolt length		Standard	44.7—45.3 {1.75—1.78}	
		Maximum	46.0 {1.81}	
Main bearing cap bolt length		Standard	110.0—110.6 {4.33—4.35}	
		Maximum	111.3 {4.38}	
Balance shaft				
Gear backlash	(mm {in})	Maximum	L3: 0.005-0.101 {0.00019—0.0039}	

TRIBUTE (L.H.D.) Face-lifted model

Item		Engine	
		L3	
Cylinder Block			
Cylinder bore diameter	(mm {in})	87.5—87.53 {3.444—3.445}	
Cylinder bore maximum out-of-round	(mm {in})	0.008 {0.0003}	
Main bearing bore diameter	(mm {in})	57.020—57.038 {2.244—2.245}	

TECHNICAL DATA

Item	Engine	
	L3	
Head gasket surface flatness		0.1 mm/general 0.05 mm/200 x 200 {0.0003 in./general} {0.0019 in./7.87 x 7.87}
Piston		
Diameter (1)	(mm {in})	87.5—87.51 {3.444—3.445}
Diameter (2)	(mm {in})	87.51—87.52 {3.4452—3.4456}
Diameter (3)	(mm {in})	87.52—87.53 {3.444—3.446}
Piston-to-bore clearance	(mm {in})	0.025—0.045 {0.0009—0.0017}
Ring groove width — top	(mm {in})	1.203—1.205 {0.0473—0.0474}
Ring groove width — 2nd	(mm {in})	1.17—1.19 {0.0460—0.0468}
Ring groove width — oil	(mm {in})	2.501—2.503 {0.0984—0.0985}
Piston skirt coating thickness	(mm {in})	0.008—0.020 {0.0003—0.0007}
Piston Pin		
Diameter	(mm {in})	20.995—21.0 {0.8266—0.8268}
Length	(mm {in})	59.6—60.4 {2.346—2.377}
Piston-to-pin clearance	(mm {in})	0.008—0.016 {0.0003—0.0006}
Pin-to-rod clearance		Press fit
Cylinder Head		
Valve lift at zero lash (exhaust)	(mm {in})	7.4 {0.2913}
Valve lift at zero lash (intake)	(mm {in})	7.9 {0.311}
Valve guide diameter	(mm {in})	5.509—5.539 {0.216—0.218}
Valve seat width — intake/exhaust	(mm {in})	0.99—1.84 {0.038—0.072}
Valve seat angle	(°)	45
Valve seat runout	(mm {in})	0.075 {0.0029}
Valve lash adjuster bore diameter	(mm {in})	31.00—31.03 {1.220—1.221}
Cam bore diameter	(mm {in})	25.015—25.040 {0.984—0.985}
Valve		
Valve head diameter — intake	(mm {in})	34.85—35.15 {1.372—1.383}
Valve head diameter — exhaust	(mm {in})	29.85—30.15 {1.175—1.187}
Valve stem diameter — intake	(mm {in})	5.470—5.485 {0.2153—0.2159}
Valve stem diameter — exhaust	(mm {in})	5.465—5.480 {0.2151—0.2157}
Valve stem-to-guide clearance — intake	(mm {in})	0.0027 {0.0009}
Valve stem-to-guide clearance — exhaust	(mm {in})	0.0029 {0.0011}
Valve face runout	(mm {in})	0.05 {0.001 in}
Valve face angle	(°)	45
Valve Spring — Compression Pressure		
Intake and exhaust (installed)	(N {kgf, lbs})	172.4 {17.576, 38.667}
Intake (valve open) 8.9 mm (0.35 in) of lift	(N {kgf, lbs})	432.5 {44.105, 97.032}
Exhaust (valve open) 7.4 mm of lift	(N {kgf, lbs})	416.1 {42.426, 93.338}
Free length	(mm {in})	44.92 {1.768}
Assembled height	(mm {in})	37.9 {1.492}
Crankshaft		
Main bearing journal diameter	(mm {in})	51.980—52.000 {2.046—2.047}
Production repair	(mm {in})	51.730—51.750 {2.036—2.037}
Main bearing clearance	(mm {in})	0.019—0.035 {0.0007—0.0013}
Connecting rod journal diameter	(mm {in})	49.980—50.000 {1.967—1.968}
Production repair	(mm {in})	49.730—49.750 {1.957—1.958}
End play	(mm {in})	0.22—0.43 {0.008—0.016}
Rings		
Width — top	(mm {in})	1.17—1.185 {0.0460—0.0466}
Width — 2nd	(mm {in})	1.197—1.199 {0.0471—0.0472}
Width — oil	(mm {in})	2.38—2.45 {0.093—0.096}
Ring gap (in bore) — top	(mm {in})	0.16—0.31 {0.006—0.012}

TECHNICAL DATA

Item	Engine	
	L3	
Ring gap (in bore) — 2nd	(mm {in})	0.33—0.48 {0.012—0.018}
Ring gap (in bore) — oil	(mm {in})	0.2—0.7 {0.007—0.027}
Valve Tappet		
Diameter	(mm {in})	30.97—30.98 {1.2192—1.2196}
Tappet-to-valve clearance — intake	(mm {in})	0.22—0.28 {0.008—0.011}
Tappet-to-valve clearance — exhaust	(mm {in})	0.27—0.33 {0.010—0.013}
Tappet-to-bore clearance	(mm {in})	0.02—0.06 {0.0007—0.0023}
Camshaft		
Lobe lift — intake	(mm {in})	8.24999 {0.32}
Lobe lift — exhaust	(mm {in})	7.80007 {0.307}
Runout (1) No. 3 Journal — Supported by No. 1 and No. 5 journals.	(mm {in})	0.03 {0.001}
Thrust clearance	(mm {in})	0.09—0.24 {0.003—0.009}
Journal diameter	(mm {in})	24.96—24.98 {0.982—0.983}
Journal-to-bore clearance	(mm {in})	0.035—0.080 {0.001—0.003}
Connecting Rod		
Bearing clearance	(mm {in})	0.027—0.052 {0.001—0.002}
Bearing thickness	(mm {in})	1.496—1.520 {0.058—0.059}
Crank bore diameter	(mm {in})	53.025—53.045 {2.087—2.088}
Pin bore diameter	(mm {in})	20.965—20.985 {0.825—0.826}
Length (center-to-center)	(mm {in})	154.8 {6.094}
Side clearance	(mm {in})	1.95—3.05 {0.076—0.120}
Axial clearance	(mm {in})	0.14—0.36 {0.005—0.014}

01

SERVICE TOOLS

01-60 SERVICE TOOLS

ENGINE SST 01-60-1

ENGINE SST

B3E016002000201

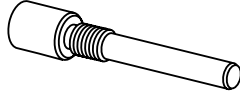
1: Mazda SST number

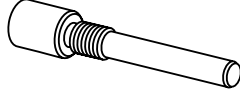
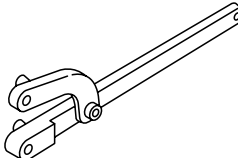
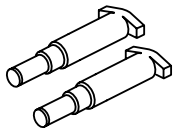
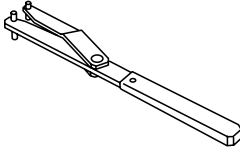
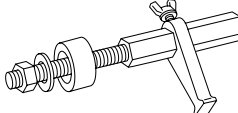
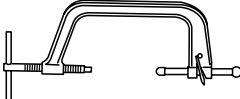
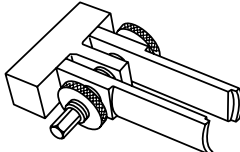
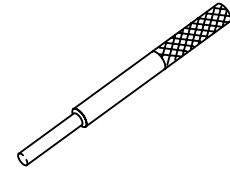
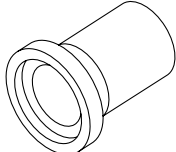
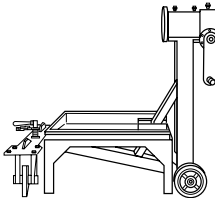
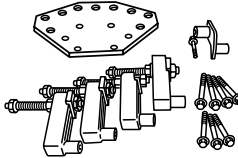
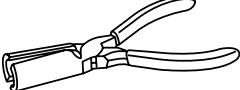
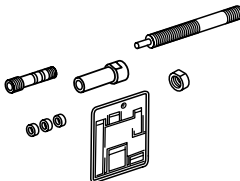

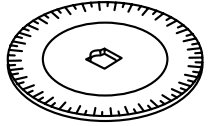
2: Global SST number

Example

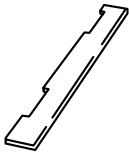
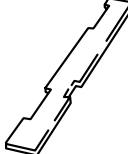
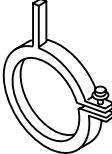
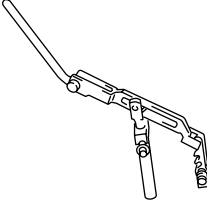
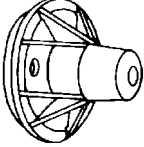
1:49 JE01 061
2:303-507

Crankshaft TDC Setting Pin



<p>1:49 JE01 061 2:303-507</p> <p>Crankshaft TDC Setting Pin</p> 	<p>1:49 UN20 5072 2:205-072</p> <p>Holder</p> 	<p>1:49 B011 105 2: -</p> <p>Adapter</p> 
<p>1:49 G032 354 2: -</p> <p>Adjusting wrench</p> 	<p>1:49 E011 1A0 2: -</p> <p>Ring gear brake set</p> 	<p>1:49 0636 100B 2: -</p> <p>Valve spring lifter arm</p> 
<p>1:49 B012 0A2 2: -</p> <p>Pivot</p> 	<p>1:49 B012 015 2: -</p> <p>Valve guide installer</p> 	<p>1:49 H010 401 2: -</p> <p>Oil seal installer</p> 
<p>1:49 0107 680A 2: -</p> <p>Engine stand</p> 	<p>1:49 L010 1A0 2: -</p> <p>Engine hanger set</p> 	<p>1:49 S120 170 2: -</p> <p>Valve seal remover</p> 
<p>1:49 L012 0A0B 2: -</p> <p>Valve seal and valve guide installer set</p> 	<p>1:49 T032 302 2: -</p> <p>Bearing installer</p> 	<p>1:49 D032 316 2: -</p> <p>Protractor</p> 

SERVICE TOOLS

<p>1:49 JE01 054 Camshaft Alignment timing Tool (Europe)</p> 	<p>49 UN30 3465 2: 303-465 Camshaft Alignment timing Tool (Except Europe)</p> 	<p>1:49 G011 201 2: - Attachment</p> 
<p>1:49 JE02 0A2 2: - Universal valve tool (Europe only)</p> 	<p>1:49 UN30 3328 2:303-328 Rear oil seal replacer</p> 	<p>-</p>